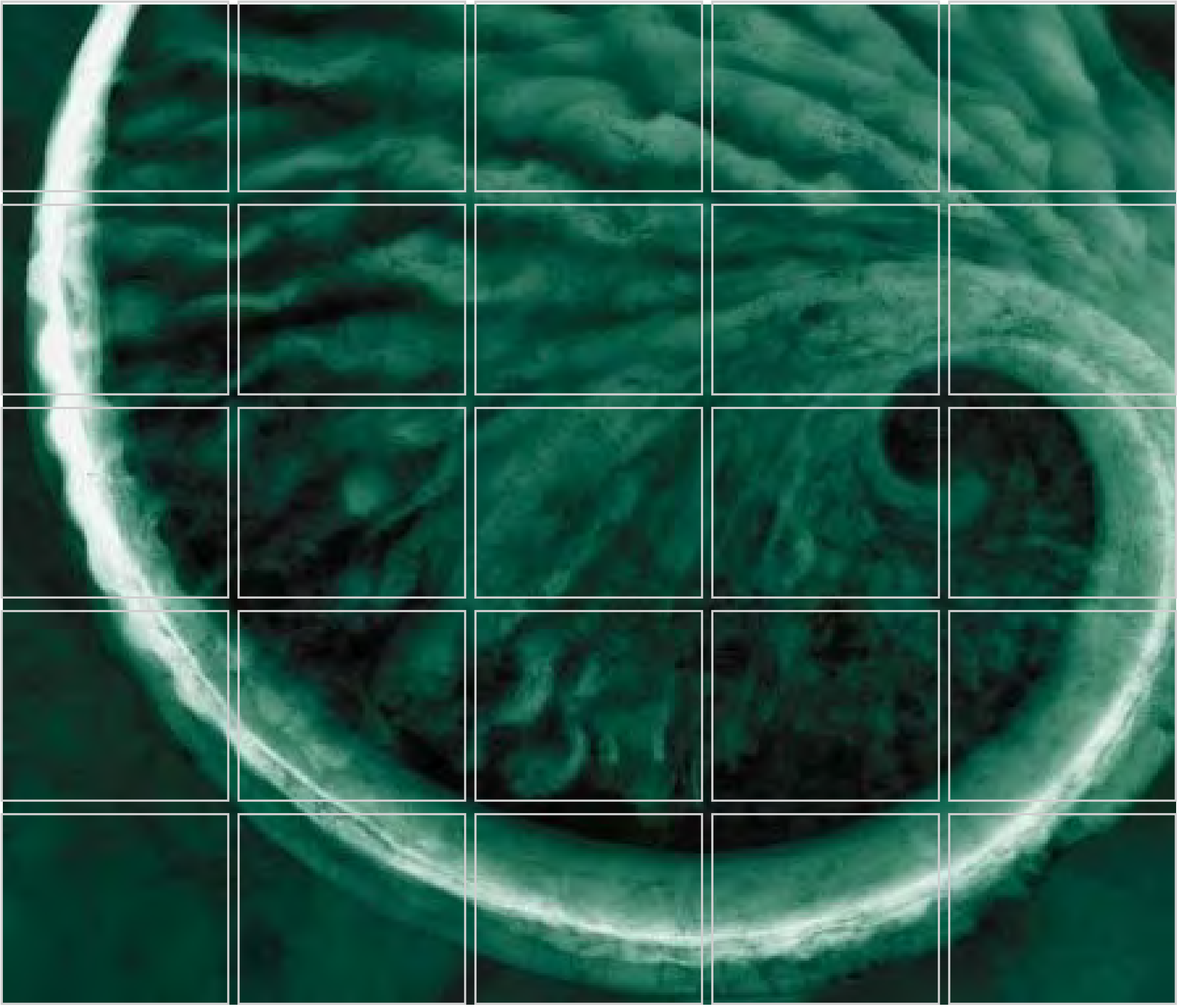

Storm Water Source Control Measure Design Update

Portland Facility
Portland, Oregon

August 2015

Prepared for:
Vigor Industrial, LLC

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Vigor Industrial, LLC

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REGISTERED PROFESSIONAL ENGINEER
78496PE
OREGON
DECEMBER 31, 2007
BRENDAN ANDREW ROBINSON
EXP. 12/31/2016

Brendan Robinson, P.E.
Project Manager

Erik Ipsen, P.E.
Partner

ERM-West, Inc.
1001 SW 5th Avenue, Suite 1010
Portland, Oregon 97204
T: 503-488-5282
F: 503-488-5142

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LIST OF ACRONYMS

µg/L	Microgram(s) per liter
BEHP	Bis(2-ethylhexyl)phthalate
BES	Bureau of Environmental Services
BMP	Best management practice
BWTP	Ballast Water Treatment Plant
DGI	Data gap investigation
DMR	Discharge Monitoring Report
EC	Electrocoagulation
EQ	Exceedance quotient
ERM	ERM-West, Inc.
JSCS	Joint Source Control Strategy
NPDES	National Pollutant Discharge Elimination System
ODEQ	Oregon Department of Environmental Quality
ODOT	Oregon Department of Transportation
PAH	Polynuclear aromatic hydrocarbon
PCB	Polychlorinated biphenyl
SCM	Source control measure
SLV	Screening Level Value
SWPCP	Storm Water Pollution Control Plan
TBT	Tributyltin
TSS	Total suspended solid
USEPA	United States Environmental Protection Agency

1.0 INTRODUCTION

This *Storm Water Source Control Design Update* was prepared by ERM-West, Inc. (ERM) on behalf of Vigor Industrial, LLC (Vigor) for the Portland Facility, located at 5555 North Channel Avenue in Portland, Oregon (the Site). The purpose of this report is to present proposed interim source control and treatment measures and an update to the design of storm water source control measures (SCMs) at the Site.

The SCMs are being implemented to control storm water as a potential contaminant pathway to the Willamette River. The storm water SCMs are also intended to enable Vigor to meet the requirements for pollutant concentration reduction under the new National Pollutant Discharge Elimination System (NPDES) General Industrial Storm Water (1200-Z) permit for the Lower Willamette River.

The report has been prepared in accordance with the Oregon Department of Environmental Quality (ODEQ) and United States Environmental Protection Agency (USEPA) Portland Harbor Joint Source Control Strategy (JSCS) guidance document (ODEQ and USEPA 2005). This report will be included as an attachment to the Site Storm Water Pollution Control Plan (SWPCP). This report incorporates responses to ODEQ and USEPA comments on the *Stormwater Data Gaps Investigation and Site-Wide Conceptual Design Update Report* (ERM 2014) received on 2 February 2015 and ODEQ comments on the *Appendix D-Storm Water Source Control and Treatment Measure Design Update* (ERM 2015).

2.0 STORM WATER SOURCE CONTROL MEASURES

Based on the conclusions of the storm water source control screening evaluation (SCSE) and the Tier II requirements of the NPDES permit, the objectives for source control are as follows:

- Achieve NPDES Tier II zinc mass removal and concentration reduction requirements for Outfalls Q, O, and M by 30 June 2015;
- Achieve NPDES permit benchmarks for aluminum, copper, iron, lead, zinc, pH, total suspended solids (TSS), oil and grease, and nitrate plus nitrite nitrogen in storm water runoff across the Site; and
- Prevent potential sediment recontamination and meet water-quality screening criteria presented in the JSCS by reducing the loading of arsenic, cadmium, copper, lead, mercury, zinc, polynuclear aromatic hydrocarbons (PAHs), bis-2-ethylhexyl-phthalate (BEHP), polychlorinated biphenyls (PCBs), and tributyltin (TBT) in storm water discharging to the Willamette River.

Aluminum was previously included as a contaminant in storm water requiring source control (ODEQ 2015). However, in the updated *Draft Final Feasibility Study Report* (USEPA 2015) for Portland Harbor, aluminum was eliminated as a contaminant of concern as it is considered "not ecologically significant." Based on this conclusion, aluminum has been removed as a contaminant requiring source control at the site. Vigor notes that under the current NPDES permit, aluminum is a sector-specific pollutant that requires monitoring and has a benchmark.

In addition to BEHP, the phthalate esters butyl benzyl phthalate, dibutylphthalate, dimethylphthalate, and di-n-octylphthalate have been detected in catch basin sediment or storm water discharge samples. Only two SLV exceedances for dibutyl phthalate have been observed in the entire storm water source control program. Exceedance quotients for both these samples were less than 10. Vigor notes that the SLV for dibutyl phthalate is based on Table 33c (OAR 340-41) and is a Water Quality Guidance Value, not a criterion. Based on this evaluation, dibutyl phthalate was considered a low priority for source control. Additionally, the updated *Draft Final Feasibility Study Report* (USEPA 2015) for Portland Harbor concluded that dibutyl phthalate was "not ecologically significant", and therefore eliminated as a contaminant of concern. Based on this conclusion, butyl benzyl phthalate, dibutylphthalate, dimethylphthalate, and di-n-octylphthalate were removed as contaminants requiring source control at the Vigor site.

2.1 PROPOSED SITE-WIDE STORM WATER MANAGEMENT

A summary of the source control evaluation conclusions and site-wide storm water management strategy, including the proposed SCM for each drainage area, is provided in Table 1. The specific conveyance re-routing and location of treatment measures are presented in Attachment A.

2.1.1 Bioretention Pond

A proposed storm water SCM (Bioretention Pond) was included in the March 2013 ODEQ-approved SWPCP update, as a required element of the NPDES permit. The proposed SCM is intended to achieve the Tier II requirements for Outfalls Q, O, and M, including the portion outside of the boundary fence (i.e., North Lagoon Avenue). A summary of the areas included in the Bioretention Pond is presented in Table 1. An updated design package for the Bioretention Pond SCM is included in Attachment B. A phased approach to implementation of the SCM was presented in the *Data Gaps Investigation and Site-Wide Conceptual Design Update Report* (ERM 2014), which was included in the ODEQ- and City-approved December 2014 SWPCP update. The Bioretention Pond is designed to eventually treat Storm Water from approximately 60 percent of the site. Vigor notes that the nomenclature of the proposed bioretention facility has been changed to the Bioretention Pond (formerly referred to as the "Southside Bioretention Pond." This change was made to more accurately reflect the total proposed catchment area, which actually encompasses large portions of the north and south sides within the eastern half of the facility. The remaining catchment areas within the facility will be addressed by the Electrocoagulation System described below.

2.1.2 Electrocoagulation System

An electrocoagulation (EC) system pilot study was conducted in 2013/2014 to evaluate EC as a potential storm water treatment technology at the site. EC is technology that generates metal hydroxide species in solution that react chemically with contaminants and promote precipitation and coagulation. The resultant floc is then removed from the effluent by settling and filtration. A summary of the EC system pilot study results is included in Table 2. The EC system demonstrated success at reducing concentrations of metals, BEHP, total PAHs, and total PCBs. The concentrations of BEHP, PAHs, and PCBs in the effluent were below detection limits.

Based on the results of the pilot study (ERM 2014), Vigor proposed to utilize a full-scale EC technology system to treat storm water from the remaining 40 percent of the site (Phase 5) the general encompasses the western half of the facility and docks. The design basis of the full-scale EC system will provided under separate cover.

2.1.3 Implementation Phasing

During Bioretention Pond permitting and construction planning in April 2015, the planned phased implementation approach was revised to account for current site operational conditions and to take advantage of opportunities for significant cost savings associated with construction sequencing.

The revised phased approach for implementation of the South Bioretention Pond SCM and achieving compliance with the NPDES Tier II requirements consists of:

- **Phase 1 (Winter 2014/Spring 2015)** – (Revised) Interim measures in have been installed in Outfalls Q, O, and M that included: continued treatment of Outfall Q runoff using a 400-gallon-per-minute EC system, application of additional best management practices (BMPs) (i.e., covering laydown materials with plastic, increased sweeping frequency), and installation of small-scale interim treatment measures (i.e., Grattix boxes) at potential sources of zinc within the catchment areas of Outfalls O and M.
- **Phase 2 (Spring 2015)** – (Revised) Interim BMPs have been installed in North Lagoon Avenue, including closure to public access, limiting industrial activities in this area, covering laydown materials with plastic, and increased sweeping frequency.
- **Phase 3 (Fall 2015)** – Construction of the South Bioretention Pond SCM and associated infrastructure to connect Outfalls Q, O, and M to the Bioretention Pond.
- **Phase 4 (Spring 2017)** – Berths 313 and 314 (Outfalls LD4-B through LD7B) reconveyance and connection to the South Bioretention Pond. Berths 303, 304, and 305 (Outfalls J through N, and N-1 to N-6) reconveyance and connection to the South Bioretention Pond.
- **Phase 5 (Spring 2017)** - Berth 312 (Outfalls LD1-A through LD4-A) to EC treatment at BWTP.

The completion of Phases 1 and 2 are intended to meet the storm water treatment objectives and implementation schedule under the NPDES permit Tier II requirements. Completion of Phase 3 is intended to complete source control and continue meeting NPDES Tier II treatment objectives. Completion of Phases 4 and 5 are intended to be completed by 30 June 2017 in order to comply with NDPES Tier II treatment measure requirements based on zinc exceedances observed in the 2014/2015 annual monitoring results. The implementation of Phases 4 and 5 are also intended to achieve source control for the Site in advance of the implementation the Portland Harbor sediment remedial action.

2.2 *NDPES TIER II INTERIM SOURCE CONTROL AND TREATMENT MEASURES*

Under the requirements of the NPDES permit, Vigor was required to implement additional measures at Outfalls Q, O, and M by 30 June 2015 with the goal of achieving the benchmarks of the permit. Vigor is utilizing a combination of interim source control and treatment measures to achieve benchmarks at Outfalls Q, O, and M until the South Bioretention Pond SCM construction is completed. The locations of proposed interim source control and treatment measures are shown in Attachment A.

2.2.1 *Outfall Q Interim Treatment Measure*

As presented in the *Storm Water Source Control Measure Design Update* (ERM 2014), a pilot EC system has been operating at the facility since May 2013. The 400-gallon-per-minute pilot EC system treats the storm water runoff from the Outfall Q catchment area. Performance monitoring results are presented in Table 2. Following system shakedown early in the monitoring period (since February 2014), the EC system has consistently achieved benchmark concentrations in the effluent, including zinc. It is anticipated that this interim treatment system will continue to achieve benchmarks until it is removed following completion of the South Bioretention Pond SCM.

2.2.2 *Additional Interim Roof Drain Treatment Measures*

Vigor will install small-scale interim treatment measures to directly treat roof drainage from Buildings 4 and 10, which were previously identified as potential sources of zinc to storm water in Outfalls O and M (ERM 2010). These treatment measures include ion absorption and filtration media, as well as biofiltration devices (“Grattix Boxes”).

2.2.2.1 *Storm Water Filtration*

Vigor is deploying storm water filtration devices containing MetalZorb® media. The MetalZorb is a sponge media that removes metals in storm water through filtration of solids and sorption of dissolved contaminants. The media will be placed in absorbent socks and deployed in storm water drain lines around Building 4. The locations of the filtration devices are shown in Attachment A.

2.2.2.2 *Grattix Boxes*

A field trial of the Grattix Box system has been implemented at a roof drain in the Outfall R basin. The preliminary results of the field trial are presented in Table 3. Applicable NPDES benchmarks were achieved in the effluent of the Grattix Box. Average concentration reductions in the effluent were: cadmium (70 percent), chromium (37 percent), copper (82 percent), lead (92 percent), and zinc (98.5 percent). Increases in aluminum, iron, and nickel were observed; however, average concentrations were below applicable NPDES benchmarks.

The results indicate that contaminants, specifically zinc, in this and other basins with effluent primarily or solely from roof drainage can be controlled through the use of individual roof drain treatment systems. The locations of Grattix Boxes installed at roof drain downspouts are presented in Attachment A. Estimated contaminant removal efficiencies are presented in Table 4.

Concentration reductions were observed in the Grattix Box pilot study for all contaminants, with the exceptions of aluminum, iron, and nickel. In these cases, the average effluent concentration was higher than the average influent concentration. The average effluent concentration of these contaminants is biased high due the concentrations of a single sample (January 2014). This sample also had the highest TSS concentrations observed during the pilot study. It is likely that the high aluminum and iron concentrations are related to the high TSS.

The average concentrations in the Grattix Box effluent were below NPDES permit benchmarks for aluminum and iron in both the influent and effluent. There is no benchmark for nickel.

Aluminum and nickel are not considered contaminants of concern for Portland Harbor and are thus not considered further in the design basis for source control. Although iron is not a contaminant of concern for Portland Harbor, the Willamette River is Section 303(d) listed for iron.

The NDPES permitted discharge limit for iron is 1 mg/L. All Grattix Box influent and effluent concentrations for iron were below the NPDES benchmark, with the exception of the single January 2014 sample. The average effluent concentration of iron was below the NPDES benchmark.

2.2.2.3 *Catch Basin Biofiltration Inserts*

Catch basins around Building 4 discharge to conveyance lines that tie directly to Outfall O and comingle with off-site street runoff. Due to configuration of the drain lines, it is not possible to treat the on-site runoff prior to mixing with the street runoff. These affected catch basins will be retrofitted with biofiltration inserts, as shown in Attachment A.

The biofiltration inserts are based on the Grattix Box design. They are installed directly in the catch basin, with compost/sand media underlain by gravel and contained within a geotextile. Due to the limited catchment sizes, low flows observed from these catch basins, and Grattix Box performance data, the biofiltration inserts are anticipated to achieve the zinc benchmark in discharge from this area. The catch basin inserts will be removed following completion of the Bioretention Pond and reconveyance construction. Performance of the interim measures will be monitored as part of the NPDES compliance monitoring program.

2.2.3 *Additional Interim Best Management Practices*

Vigor has intensified the use of BMPs throughout the Outfall O and M catchment areas. This effort is focused on reducing the source of zinc to runoff in these active areas of the site. Additional BMPs that have been implemented include:

- Covering materials coated with zinc primer, such as metal plates, with plastic to prevent rain from contacting the equipment; and
- Increased sweeping frequency from monthly to weekly.

These BMPs will reduce the sources of zinc to storm water.

2.3 *SOURCE CONTROL MEASURE DESIGN BASIS*

The objective of the proposed permanent SCMs is to prevent sediment recontamination of Willamette River sediments following sediment remediation in the Portland Harbor Superfund Site by reducing the loading of contaminants requiring source control in storm water discharging to the Willamette River. In addition to reducing storm water discharge volume, the goal of the SCMs is also to reduce concentrations of contaminants (specifically zinc) in storm water to below NPDES benchmark levels in accordance with the Tier II requirements.

2.3.1 *Source Control Measure Design Basis*

There are no established source control criteria or effluent concentrations for storm water to prevent recontamination of sediment. Recently-published Preliminary Remediation Goals for Portland Harbor (USEPA 2015) are applicable to surface water. Additionally, there is no established design storm for the purpose of sizing treatment facilities to achieve source control in Portland Harbor. Several agencies, including the City of Portland and the Oregon Department of Transportation (ODOT), have established design storms for storm water quality. An evaluation of these design storms was presented in the *Infiltration Pond Sizing Analysis* (ERM 2013).

The City of Portland and ODOT water quality design storms are backed by rigorous analysis with the objective of achieving a high degree of runoff capture (City of Portland 2007; ODOT 2008). The goal in selecting the design storm is to provide sufficient capture such that both NPDES permit benchmarks and Portland Harbor source control objectives are achieved. As presented in the *DEQ Industrial Stormwater Permits: Tier II Revised Stormwater Pollution Control Plan Checklist* (ODEQ 2014), the appropriate water quality design storm for NPDES Tier II treatment measures is 50 percent of the 2-year, 24-hour rainfall depth (i.e., a design storm of 1.25 inches at Swan Island). A storm water model was developed to evaluate the performance of the proposed design basis of the Bioretention Pond SCM.

Rainfall runoff at the Site was modeled using the USEPA's Storm Water Management Model in order to evaluate the expected performance of various proposed design storms. The effectiveness of the Bioretention Pond, when sized to treat the design storm (1.25 inches in 24 hours), was tested by modeling the actual hourly rainfall record for 1948 through 2012 (64 years). The runoff volume in excess of the pond volume is discharged through an engineered high-flow bypass during extreme events. The rainfall record evaluation indicated that approximately 98 percent of storm water was treated when using a facility sized to treat the 1.25-inch storm.

The ODEQ has approved a design storm of 1.25 inches as an appropriate design storm size for the purpose meeting source control at the Site. Vigor is proposing to use the 1.25-inch storm as the design basis for both the

Bioretention Pond (Phases 3 and 4) and the full-scale EC system (Phase 5). Modeled storm water runoff volumes for the 1.25-inch design storm are presented in Attachment C. The subsequent hydraulic design and the combined total expected runoff volumes for the Bioretention Pond (i.e., Phases 3 and 4) are presented in Attachment D.

The Bioretention Pond was sized to treat the 1.25-inch storm, with an assumed minimum media infiltration rate of 10 inches per hour, and a maximum allowable ponding depth of 12 inches to prevent media compaction. Actual media infiltration rates are anticipated to be higher than 10 inches per hour. The pond design details including total runoff, treated, and bypass volume are summarized in Table 5.

Vigor notes that following implementation of the SCMs, their effectiveness will need to be evaluated, including an evaluation of high-flow bypasses. The performance monitoring plan presented in Section 3 of this report describes the proposed data collection. Vigor also notes that a sediment recontamination evaluation may be performed, if required. The need for a sediment recontamination evaluation will be depend on SCM performance monitoring results, development of final Portland Harbor Preliminary Remediation Goals, and selection of final sediment remedy for the adjacent area of the Willamette River and Swan Island Lagoon.

2.3.2 NPDES Tier II Contaminant Concentration Reduction

In order to meet the NPDES Tier II requirements, an effluent concentration target must be achieved. The proposed SCMs consist of systems that treat and then discharge treated effluent, which requires an effluent concentration target to be achieved in order to comply with NPDES permit benchmarks (e.g., 120 micrograms per liter [µg/L] for zinc). For the purpose of meeting the current Tier II requirements, the runoff from Outfalls Q, O, and M is required to be treated to achieve the zinc benchmark. Zinc is currently the only constituent with a Tier II contaminant concentration reduction requirement.

In order to evaluate the feasibility of the proposed SCMs to achieve the zinc benchmark, estimated treatment efficiencies were applied to the combined annual runoff volume and average zinc concentrations (calculated from the DGI data) for each outfall that contributes to each of the SCMs.

The estimated zinc reductions feasible for each of the proposed SCMs were obtained through literature review, including the *International Stormwater BMP Database Pollutant Category Summary Statistical Addendum*

(Geosyntec and Wright 2012), EC pilot study performance data, and the Grattix Box pilot study. Estimated zinc removal efficiencies for the proposed SCMs and treatment facilities are presented in Tables 2, 3, and 4.

The concentrations of zinc observed in Outfall Q runoff are higher by approximately an order of magnitude than the influent concentrations observed in many published studies of treatment system performance (Geosyntec and Wright 2012). Studies that evaluated bioretention system treatment of zinc at similar levels to those observed at Outfall Q (600 to 2,000 µg/L) reported consistent zinc removal efficiencies in excess of 98 percent, with effluent concentrations usually below 25 µg/L (Davis et al. 2003). Similar zinc removal efficiencies were observed in the Grattix Box pilot study, which use a similar technology (i.e., biofiltration) and had higher influent zinc concentrations than Outfall Q. For the purpose of estimating effluent concentrations, a treatment efficiency of 95 percent was assumed for the Bioretention Pond.

High zinc removal efficiency has been achieved in the Bioretention Pond operating at the Port of Vancouver, Washington, facility since 2012. This Bioretention Pond has successfully treated storm water to below benchmarks consistently, such that a monitoring waiver has been applied on the basis of the lack of exceedances. The Port of Vancouver has similar industrial activities, rainfall conditions, and catchment sizes as the Vigor facility. Similar treatment results are anticipated at the proposed South Bioretention Pond SCM. The Bioretention Pond for the Vigor facility has been designed, in part, on the system used at the Port of Vancouver.

Calculated combined effluent concentrations and the estimated annual zinc mass removal from each of the proposed SCMs are presented in Table 6. As shown in Table 6, based on the estimated removal efficiencies, the combined effluent flow from the South Bioretention Pond that will capture runoff from the current NPDES Tier II outfalls (Q, O, and M) is anticipated to have a zinc concentration that is below the NPDES permit benchmark.

The estimated effluent zinc concentrations from the bioretention pond, EC System, and Grattix boxes (including biofilters) are also below the NPDES permit benchmark for outfalls.

2.3.3 *Source Control Mass Reduction*

The objective of source control is to reduce the mass flux of contaminants to the Willamette River in order to prevent recontamination of sediment. By removing the contaminants from the storm water flow, the proposed

SCMs will reduce the mass of contaminants discharging from the Site in storm water. Estimated removal efficiencies for each identified source control contaminant and the proposed SCMs are presented in Table 4.

The average annual rainfall of 37.9 inches was used to estimate annual contaminant mass removal rates for each proposed SCM, which are presented in Table 6.

PAH and PCB mass reductions for the Grattix Box pilot study were not able to be calculated as the influent and effluent concentrations were both below detection limits. BEHP and TBT were not included in the list of analytes for the Grattix Box pilot study. In order to estimate average annual reductions of these analytes for the Grattix Box and Bioretention Pond SCMs, removal efficiencies were assumed to be equivalent to TSS removal.

The estimated annual total site-wide mass removal of metals is significant, ranging between 41 percent for arsenic (0.016 pounds) and 95 percent for zinc (30.8 pounds). Mass removal rates in these ranges are likely to control the potential for sediment recontamination and reduce concentrations below applicable criteria.

Concentration reductions for PAHs, PCBs, BEHP, and TBT are significant, as estimated removal efficiencies are typical greater than 70 percent. Estimated annual mass removal quantities are 0.001 pounds of TBT, 0.0115 pounds of PAHs, 0.0014 pounds of PCBs, and 0.129 pounds of BEHP. These mass removal quantities are small compared to metal removal rates as influent concentrations are significantly lower.

It should be noted that the estimated annual removal rates use the conservative assumption that contaminant concentrations are constant throughout a storm. The SCMs are designed to treat the initial part of storm events, including the first flush portion of the storm, which typically has higher concentrations of contaminants than the latter stages of the storm. Treating the first flush will remove a greater portion of the contaminant mass than estimated in Table 6.

3.0 PERFORMANCE MONITORING PLAN

The goals of the performance monitoring program for the Vigor SCMs are to:

- Provide sufficient data to comply with the NPDES 1200Z permit requirements;
- Provide sufficient data to evaluate the effectiveness of the storm water SCMs at preventing potential sediment recontamination of the Willamette River following implementation of an in-water sediment remedial action; and
- Provide sufficient data to determine what, if any, improvement to SCM performance can be achieved through adaptive management.

The NPDES 1200Z permit requirements and the source control evaluation monitoring requirements have different objectives. The purpose of the 1200Z monitoring is to determine whether storm water discharge concentrations meet permit benchmarks. The objective of the source control monitoring is to evaluate whether sediment will be recontaminated. This may potentially require an evaluation of mass loading based on contaminant concentrations and flows.

3.1 PROPOSED PHASE 3 STORM WATER MONITORING PROGRAM

The storm water SCM performance monitoring program is intended to be implemented as an additional component of the NPDES 1200Z monitoring program at the site. The 1200Z monitoring program is based on sampling a subset of seven of the 53 site-wide outfalls. Discharge from these seven drainage areas will continue to be monitored as required under the 1200Z permit. Following the construction and reconveyance of the Phase 3 South Bioretention pond, discharge from two of the sampled outfalls (Q and M) will be combined into a single discharge point (i.e., the Bioretention Pond effluent).

3.1.1 Storm Water Discharge Monitoring

The storm water sampling program will consist of collecting grab samples of the storm water during four events each water year (July through June) in conjunction with NPDES permit monitoring requirements. The proposed analytical scope for Phase 3 is presented in Table 7.

Flows will be monitored at the discharge points of each of the SCMs. During Phase 3, the influent flow rate to the Bioretention Pond will be monitored, as well as the effluent flow rate. This will enable the infiltrated (i.e., retained on site) volume of runoff to be estimated. Influent and effluent flow monitoring points are vaults fitted with flow totalizers and sample collection ports. This will enable influent and effluent flow volume and quality to be monitored.

As shown in the Attachment B, the Bioretention Pond has a high level flow bypass riser to allow for emergency bypass in the event that the media infiltration rate is reduced. The water level in the Bioretention Pond will be monitored and recorded continuously. This will enable the volume of any potential high-flow bypass to be estimated. The sample collection point is downstream of the connection of the high-flow bypass. Samples collected at this point will be representative of the combined effluent discharging from the Bioretention Pond.

A total of four Bioretention Pond influent samples will be collected during the first year of monitoring. These samples will be collected during the same events as the effluent samples in order to confirm mass removal performance of the Bioretention Pond SCM. The need for additional influent monitoring will be evaluated based on the performance of the Bioretention Pond and potential requirements for adaptive management.

2.2.2.3 Outfall P Monitoring

Stormwater discharge from Outfall P was monitored as part of a data gaps investigation implemented in 2013/2014 (ERM 2014). Additional data is required complete the storm water source control evaluation for this drainage area (ODEQ 2015). Specifically, samples meeting the first flush criteria provided in the *ODEQ Guidance for Evaluating the Stormwater Pathway at Upland Sites* need to be collected. Vigor is proposing to collect an additional four samples from Outfall P during the fall and winter of 2015/2016. The time of start of discharge from Outfall P will be visually confirmed and at least two of the samples will be collected within the first 30 minutes of the start of discharge.

3.1.2 Performance Monitoring Reporting

Storm water SCM performance monitoring will coincide with the required NPDES permit reporting schedule. Performance monitoring results will be presented in a memorandum following each sampling event. An annual performance monitoring report will be prepared that presents the consolidated results of the previous water year monitoring results (July through June), an evaluation of the performance of the SCM, additional source control evaluation sampling results (i.e. Outfall P resampling), and recommendations for additional monitoring or potential changes to the SCM to improve performance.

The potential need for a sediment recontamination evaluation will be determined based on the performance monitoring results that incorporate potential system performance improvements implemented as part of the adaptive management program. In the event a sediment recontamination evaluation is required, the scope and methods will be presented in a separate work plan.

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Tables

Outfall	Current Activities Conducted in Drainage Zone	NPDES Rep Outfall Group[1]	Representative Sampling Point	Compounds Requiring Source Control[2]	Proposed Source Control Action	Implementation Phase
A	Staging area for vessels at berth; waste transfer from ships; heavy crane use.	1	G	As, Cd, Cu, Hg, Pb, Zn, BEHP, PAH, PCB, TBT	EC System SCM	Phase 5
B	Staging area for vessels at berth; waste transfer from ships; heavy crane use.	1	G	As, Cd, Cu, Hg, Pb, Zn, BEHP, PAH, PCB, TBT	EC System SCM	Phase 5
C	Crane use; vehicle traffic.	1	G	As, Cd, Cu, Hg, Pb, Zn, BEHP, PAH, PCB, TBT	EC System SCM	Phase 5
D	Roadway; craneway; laydown area; <10 day hazardous waste transfer facility area.	2	E	As, Cd, Cu, Hg, Pb, Zn, BEHP, PAH, PCB, TBT	EC System SCM	Phase 5
E	Covered painting and blasting; roadway; craneway; administrative office space; parking lots; machinery and rolling stock repair and storage.	2	E	As, Cd, Cu, Hg, Pb, Zn, BEHP, PAH, PCB, TBT	EC System SCM	Phase 5
F	Roadway; craneway; laydown area; <10 day hazardous waste transfer facility area.	1	G	As, Cd, Cu, Hg, Pb, Zn, BEHP, PAH, PCB, TBT	EC System SCM	Phase 5
G	Crane- and roadways; material laydown area (metal, wood, trailers).	1	G	As, Cd, Cu, Hg, Pb, Zn, BEHP, PAH, PCB, TBT	EC System SCM	Phase 5
H	Crane- and roadways; material laydown area (metal, wood, trailers).	1	G	As, Cd, Cu, Hg, Pb, Zn, BEHP, PAH, PCB, TBT	EC System SCM	Phase 5
I	Crane-, rail- and roadways; equipment and material laydown area; indoor substation.	3	S	As, Cd, Cu, Hg, Pb, Zn, BEHP, PAH, PCB, TBT	EC System SCM	Phase 5
J	Crane-, rail- and roadways; equipment and material laydown area (metal, wood).	1	G	As, Cd, Cu, Hg, Pb, Zn, BEHP, PAH, PCB, TBT	South Bioretention Pond SCM	Phase 4
J1	Crane-, rail- and roadways; equipment and material laydown area (metal, wood).	1	G	As, Cd, Cu, Hg, Pb, Zn, BEHP, PAH, PCB, TBT	South Bioretention Pond SCM	Phase 4
J2	Crane-, rail- and roadways.	1	G	As, Cd, Cu, Hg, Pb, Zn, BEHP, PAH, PCB, TBT	South Bioretention Pond SCM	Phase 4
J3	Crane-, rail- and roadways.	1	G	As, Cd, Cu, Hg, Pb, Zn, BEHP, PAH, PCB, TBT	South Bioretention Pond SCM	Phase 4
K	SE Building 10; provides roof drainage.	3	S	As, Cd, Cu, Hg, Pb, Zn, BEHP, PAH, PCB, TBT	South Bioretention Pond SCM or Grattix Boxes	Phase 4
L	Fiber optic cable and miscellaneous equipment storage for Tyco vessel Global Sentinel at B304; parking, rail-, crane- and roadways; steel laydown.	6	L	As, Cd, Cu, Hg, Pb, Zn, BEHP, PAH, PCB, TBT	South Bioretention Pond SCM	Phase 4
L1	Fiber optic cable and miscellaneous equipment storage for Tyco vessel Global Sentinel at B304; parking, rail-, crane- and roadways; steel laydown.	3	S	As, Cd, Cu, Hg, Pb, Zn, BEHP, PAH, PCB, TBT	South Bioretention Pond SCM	Phase 4
*M	Rail- and roadways; steel fabrication; indoor/covered coating; parts cleaning; outside materials storage; vehicle traffic; indoor paint/solvent storage.	4	M	As, Cd, Cu, Hg, Pb, Zn, BEHP, PAH, PCB, TBT	Interim BMPs and treatment measures, follow by South Bioretention Pond SCM	Phase 3
M1	Crane- and major roadways; parking; material laydown area (metal, wood, trailers).	2	E	As, Cd, Cu, Hg, Pb, Zn, BEHP, PAH, PCB, TBT	South Bioretention Pond SCM	Phase 3
N	Covered and Secured Chemical Storage; Roadway. Previous Use: Floating home construction.	3	S	As, Cd, Cu, Hg, Pb, Zn, BEHP, PAH, PCB, TBT	South Bioretention Pond SCM	Phase 4
N1	Parking and roadway	1	G	As, Cd, Cu, Hg, Pb, Zn, BEHP, PAH, PCB, TBT	South Bioretention Pond SCM	Phase 4
N2	Parking and roadway	1	G	As, Cd, Cu, Hg, Pb, Zn, BEHP, PAH, PCB, TBT	South Bioretention Pond SCM	Phase 4
N3	Parking and roadway	1	G	As, Cd, Cu, Hg, Pb, Zn, BEHP, PAH, PCB, TBT	South Bioretention Pond SCM	Phase 4
N4	Parking and roadway	1	G	As, Cd, Cu, Hg, Pb, Zn, BEHP, PAH, PCB, TBT	South Bioretention Pond SCM	Phase 4
N5	Parking and roadway	1	G	As, Cd, Cu, Hg, Pb, Zn, BEHP, PAH, PCB, TBT	South Bioretention Pond SCM	Phase 4
N6	Parking and roadway	1	G	As, Cd, Cu, Hg, Pb, Zn, BEHP, PAH, PCB, TBT	South Bioretention Pond SCM	Phase 4
*O	Main roadways - heavy vehicle traffic; steel fabrication, stainless steel fabrication; welding; administrative offices.	4	Q	As, Cd, Cu, Hg, Pb, Zn, BEHP, PAH, PCB, TBT	Interim BMPs and treatment measures, follow by South Bioretention Pond SCM	Phase 3
*P	Employee parking lot.	5	P	As, Cd, Cu, Hg, Pb, Zn, BEHP, PAH, PCB, TBT	Additional Monitoring, potential exclusion from source control	Phase 3
Q	Parking lots and roadways; administrative offices; central utility boiler; indoor/covered painting and blasting; covered, secured and bermed 90-day hazardous waste storage area; facility materials recycling, transfer and consolidation area; main paint/solvent	4	Q	As, Cd, Cu, Hg, Pb, Zn, BEHP, PAH, PCB, TBT	EC is Interim SCM followed by South Bioretention Pond SCM	Phase 3
R	Roadways; parking; administrative offices; shipyard materials and equipment shipping and receiving; electrical equipment servicing; carpentry; covered parts/tools warehousing; metal fabrication; medical testing.	3	S	As, Cd, Cu, Hg, Pb, Zn, BEHP, PAH, PCB, TBT	Individual roof drain Grattix box pilot test. If not effective, EC System SCM	Phase 5
R1	Roof drainage	2	E	As, Cd, Cu, Hg, Pb, Zn, BEHP, PAH, PCB, TBT	Included in EC System SCM or Grattix Box	Phase 5
S	Roadway; parking; steam/pressure washing equipment machinery repair.	3	S	As, Cd, Cu, Hg, Pb, Zn, BEHP, PAH, PCB, TBT	EC System SCM	Phase 5
S1	Roadway; parking	5	LD-1B	As, Cd, Cu, Hg, Pb, Zn, BEHP, PAH, PCB, TBT	EC System SCM	Phase 5
T	Roadway, vehicle traffic; Building 50 roof drainage.	3	S	As, Cd, Cu, Hg, Pb, Zn, BEHP, PAH, PCB, TBT	EC System SCM	Phase 5
LD-1A	Laydown area; roadway.	5	LD-1B	As, Cd, Cu, Hg, Pb, Zn, BEHP, PAH, PCB, TBT	EC System SCM	Phase 5
LD-1B	Laydown area; abrasive blast grit storage and distribution; roadway.	5	LD-1B	As, Cd, Cu, Hg, Pb, Zn, BEHP, PAH, PCB, TBT	EC System SCM	Phase 5
LD-2A	Laydown area; administrative office; roadway.	5	LD-1B	As, Cd, Cu, Hg, Pb, Zn, BEHP, PAH, PCB, TBT	EC System SCM	Phase 5
LD-2B	Laydown area; roadway.	5	LD-1B	As, Cd, Cu, Hg, Pb, Zn, BEHP, PAH, PCB, TBT	EC System SCM	Phase 5

Table 1
Source Control Data Evaluation
Storm Water Source Control Measure Design Update
Storm Water Source Control Measures
Vigor Industrial, LLC

Outfall	Current Activities Conducted in Drainage Zone	NPDES Rep Outfall Group[1]	Representative Sampling Point	Compounds Requiring Source Control[2]	Proposed Source Control Action	Implementation Phase
LD-2C	Laydown area; roadway.	5	LD-1B	As, Cd, Cu, Hg, Pb, Zn, BEHP, PAH, PCB, TBT	EC System SCM	Phase 5
LD-3A	Laydown area; roadway.	5	LD-1B	As, Cd, Cu, Hg, Pb, Zn, BEHP, PAH, PCB, TBT	EC System SCM	Phase 5
LD-3B	Laydown area; roadway; covered special waste holding area.	5	LD-1B	As, Cd, Cu, Hg, Pb, Zn, BEHP, PAH, PCB, TBT	EC System SCM	Phase 5
LD-3C	Laydown area; roadway; covered special waste holding area.	5	LD-1B	As, Cd, Cu, Hg, Pb, Zn, BEHP, PAH, PCB, TBT	EC System SCM	Phase 5
LD-4A	Laydown area; administrative office; roadway.	5	LD-1B	As, Cd, Cu, Hg, Pb, Zn, BEHP, PAH, PCB, TBT	EC System SCM	Phase 5
LD-4B	Laydown area; roadway.	5	LD-1B	As, Cd, Cu, Hg, Pb, Zn, BEHP, PAH, PCB, TBT	South Bioretention Pond SCM	Phase 4
LD-4C	Laydown area; roadway.	5	LD-1B	As, Cd, Cu, Hg, Pb, Zn, BEHP, PAH, PCB, TBT	South Bioretention Pond SCM	Phase 4
LD-5A	Laydown area; roadway.	5	LD-1B	As, Cd, Cu, Hg, Pb, Zn, BEHP, PAH, PCB, TBT	South Bioretention Pond SCM	Phase 4
LD-5B	Laydown area; roadway.	5	LD-1B	As, Cd, Cu, Hg, Pb, Zn, BEHP, PAH, PCB, TBT	South Bioretention Pond SCM	Phase 4
LD-5C	Laydown area; roadway.	5	LD-1B	As, Cd, Cu, Hg, Pb, Zn, BEHP, PAH, PCB, TBT	South Bioretention Pond SCM	Phase 4
LD-6A	Laydown area; administrative office; roadway.	5	LD-1B	As, Cd, Cu, Hg, Pb, Zn, BEHP, PAH, PCB, TBT	South Bioretention Pond SCM	Phase 4
LD-6B	Laydown area; roadway. Previous use: Coal Cobb truck holding area and roadway.	5	LD-1B	As, Cd, Cu, Hg, Pb, Zn, BEHP, PAH, PCB, TBT	South Bioretention Pond SCM	Phase 4
LD-7A	Laydown area; roadway.	5	LD-1B	As, Cd, Cu, Hg, Pb, Zn, BEHP, PAH, PCB, TBT	South Bioretention Pond SCM	Phase 4
LD-7B	Laydown area; roadway.	5	LD-1B	As, Cd, Cu, Hg, Pb, Zn, BEHP, PAH, PCB, TBT	South Bioretention Pond SCM	Phase 4
UT-1	Utility tunnel drain	NA		--	--	
UT-2	Utility tunnel drain	NA		--	--	

Notes:
* = Drainage basin information is for Cascade General owned property only; City of Portland owned property/catch basins are not included.
-- = Not Sampled
EQ = Exceedance Quotient
NPDES = National Pollutant Discharge Elimination System
SCM = Source Control Measure
SLV = Screening Level Value
SCSE = Source Control Screening Evaluation
EC = Electrocoagulation

1 = Representative outfalls based on *Vigor Industrial Portland Facility - Determination of Representative Storm Water Outfalls* (ERM 2011) and ODEQ personal communication 28 November 2012.
2 = The determination for source control is based on the results of the Stormwater Source Control Screening Evaluation, including a comparison to JSCS SLVs and weight of evidence evaluation
3 = Priority for source control determined from comparison to G*uidance for Evaluating the Stormwater Pathway at Upland Sites: Appendix E: Tool for Evaluating Stormwater Data* (ODEQ 2010)

Table 2
Electrocoagulation System Pilot Study Analytical Results
Storm Water Source Control Measure Design Update
Storm Water Source Control Measures
Vigor Industrial, LLC

Outfall					OUTFALL Q									
Date					4/4/2013	5/1/2013	9/27/2013	1/7/2014	2/19/2014	3/28/2014	4/23/2014	6/12/2014	7/23/2014	Average[1]
Sample Type					DGI/NPDES	PS	DGI/NPDES	DGI/NPDES	PS	PS	N	DGI/NPDES	DGI/NPDES	
Sample ID					OUTFALL-Q-040413	NFLUENT_COMP_05011	OUTFALL Q-092713	UTFALL Q-PRE EC 1/7/	UTFALL Q-PRE EC 2/19/	utfall Q-PRE EC 032820	utfall Q-PRE EC 042320	TFALL- Q PRE EC -061	SW #3 Pre-EC	
Analyte	Unit	NPDES Benchmark	NPDES Reference Concentration	JSCS SLV										
Metals														
Aluminum	µg/L	750		200	295	203	153	2570	159	497	204	800	105	554
Arsenic	µg/L			0.045	< 2.00	0.934	1.66	2.16	< 1.00	1.43	1.1	3.58		1.546
Cadmium	µg/L			0.094	0.578	0.322	0.522	1.13	< 0.200	0.356	0.2	0.989	1.03	0.581
Chromium	µg/L			100	4.62	3.32	2.17	16.7	1.94	6.27	2.46	9.59	1.9	5.44
Copper	µg/L	20		2.7	95	107	43.3	290	32	96.8	34.7	255	110	118.2
Iron	µg/L	1000			1760 Q	894	624	16000	1210	6880	1200	5760	1170	3944
Lead	µg/L	40		0.54	9.93	27.7	3.93	23.7	3.9	7.28	4.43	19.5	2.4	11.42
Mercury	µg/L			0.77	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.05	< 0.05	0.12		0.04
Nickel	µg/L			16	5.4	4.44	3.56	20	2.92	7.81	2.88	11.8	6.39	7.24
Selenium	µg/L			5	< 2.00	< 2.00	< 1.00	0.533 J	< 1.00	< 1.00	< 1.00	< 1.00		0.63
Zinc	µg/L	120		36	1710	889	1710	3330	1050	1910	1260	3650	2970	2053.2
Tributyltin	µg/L			0.072	< 0.050	< 0.050	< 0.0050	0.059	0.011	0.02	0.34	0.14		0.08
PCBs														
Aroclor 1016	µg/L			0.96	< 0.00935 UQ	< 0.0206	< 0.00943	< 0.0196	< 0.00952	< 0.00980	< 0.0971	< 0.00943	< 0.0208	< 0.0486
Aroclor 1221	µg/L			0.034	< 0.00935 UQ	< 0.0206	< 0.00943	< 0.0196	< 0.00952	< 0.00980	< 0.0971	< 0.00943	< 0.00990	< 0.0486
Aroclor 1232	µg/L			0.034	< 0.00935 UQ	< 0.0206	< 0.00943	< 0.0196	< 0.00952	< 0.00980	< 0.0971	< 0.00943	< 0.0535	< 0.0486
Aroclor 1242	µg/L			0.034	< 0.00935 UQ	< 0.0206	< 0.00943	< 0.0196	< 0.00952	< 0.00980	< 0.0971	< 0.00943	< 0.0248	< 0.0486
Aroclor 1248	µg/L			0.034	0.0166 JQ	< 0.0206	< 0.00943	< 0.0196	< 0.0190	< 0.00980	< 0.0971	< 0.00943	< 0.0198	0.0132
Aroclor 1254	µg/L			0.034	< 0.00935 UQ	< 0.0206	< 0.00943	< 0.0196	< 0.0190	< 0.00980	< 0.0971	< 0.00943	< 0.0198	< 0.0486
Aroclor 1260	µg/L			0.034	< 0.00935 UQ	< 0.0206	< 0.00943	< 0.0196	< 0.0190	< 0.00980	< 0.0971	0.0138 J	< 0.0090	0.0123
Aroclor 1262	µg/L				< 0.00935 UQ	< 0.0206	< 0.00943	< 0.0196	< 0.00952	< 0.00980	< 0.0971	< 0.00943		< 0.0486
Aroclor 1268	µg/L				< 0.00935 UQ	< 0.0206	< 0.00943	< 0.0196	< 0.00952	< 0.00980	< 0.0971	< 0.00943		< 0.0486
Total PCBs	µg/L		2	0.0000064	0.0306	< 0.0206	< 0.00943	< 0.0196	< 0.019	< 0.0098	< 0.0971	0.0279	< 0.0198	0.0282
Pesticides														
4,4-DDE	µg/L		0.01	0.000022	< 0.00467 UQ	< 0.00515	< 0.00476	< 0.00490	< 0.00521	< 0.0297	< 0.0100	< 0.00481	< 0.00971	< 0.0149
4,4-DDT	µg/L		1.1	0.000022	< 0.0280 UQ	< 0.0309	< 0.0286	< 0.0294	< 0.0312	< 0.0297	< 0.0300	< 0.0288	< 0.0291	< 0.016
Aldrin	µg/L		3	0.000005	< 0.0280 UQ	< 0.0309	< 0.0286	< 0.0294	< 0.0312	< 0.0297	< 0.0300	< 0.0288	< 0.0291	< 0.016
alpha-Chlordane	µg/L			0.000081	< 0.0280 UQ	< 0.0309	< 0.0286	< 0.0294	< 0.0312	< 0.0297	< 0.0300	< 0.0288	< 0.0291	< 0.016
Chlordane, Technical	µg/L		2.4	0.000081	< 0.346 UQ	< 0.381	< 0.352	< 0.363	< 0.385	< 0.366	< 0.370	< 0.356	< 0.359	< 0.197
Dieldrin	µg/L		0.24	0.0000054	< 0.0187 UQ	< 0.0206	< 0.0190	< 0.0196	< 0.0208	< 0.0198	< 0.0200	< 0.0192	< 0.0194	< 0.0107
gamma-Chlordane	µg/L		2.4	0.000081	< 0.0280 UQ	< 0.0309	< 0.0286	< 0.0294	< 0.0312	< 0.0297	< 0.0300	< 0.0288	< 0.0291	< 0.016
Hexachlorobenzene	µg/L		1	0.000029	< 0.0187 UQ	< 0.0206	< 0.0190	< 0.0196	< 0.0208	< 0.0198	< 0.0200	< 0.0192	< 0.0583	< 0.0292
Polycyclic Aromatic Hydrocarbons														
1-Methylnaphthalene	µg/L				< 0.0935	< 0.0825	< 0.0762	< 0.388	< 0.0762	< 0.0808	< 0.0777	< 0.385		< 0.196
2-Methylnaphthalene	µg/L				< 0.0935	< 0.0825	< 0.0762	< 0.388	< 0.0762	< 0.0808	< 0.0777	< 0.385		< 0.196
Acenaphthene	µg/L		95	99	< 0.0467	< 0.0412	< 0.0381	< 0.194	< 0.0381	< 0.0404	< 0.0388	< 0.192	< 0.510	< 0.255
Acenaphthylene	µg/L			0.2	< 0.0467	< 0.0412	< 0.0381	< 0.194	< 0.0381	< 0.0404	< 0.0388	< 0.192		< 0.098
Anthracene	µg/L		2900	0.2	< 0.0467	< 0.0412	< 0.0381	< 0.194	< 0.0381	< 0.0404	< 0.0388	< 0.192	< 0.510	< 0.255
Benzo(a)anthracene	µg/L		1	0.0018	< 0.0467	< 0.0412	< 0.0381	< 0.194	< 0.0381	< 0.0404	< 0.0388	< 0.385	< 0.510	< 0.255
Benzo(a)pyrene	µg/L		1	0.0018	< 0.701 UQ	< 0.124	< 0.0571	< 0.291	< 0.0571	< 0.0606	< 0.0583	< 0.288	< 0.510	< 0.351
Benzo(b)fluoranthene	µg/L		1	0.0018	< 0.701 UQ	< 0.0619	< 0.0571	< 0.291	< 0.0571	< 0.0606	< 0.0583	< 0.288	< 0.510	< 0.351
Benzo(g,h,i)perylene	µg/L			0.2	< 0.467 UQ	< 0.0412	< 0.0381	< 0.194	< 0.0762	< 0.0404	< 0.0388	< 0.192		< 0.234
Benzo(k)fluoranthene	µg/L		1	0.0018	< 0.701 UQ	< 0.0619	< 0.0571	< 0.291	< 0.0571	< 0.0606	< 0.0583	< 0.288	< 0.510	< 0.351
Chrysene	µg/L		1	0.0018	0.0721 J	< 0.0412	< 0.0381	< 0.194	< 0.0381	< 0.0404	< 0.0388	< 0.385	< 0.510	0.079
Dibenzo(a,h)anthracene	µg/L		1	0.0018	< 0.467 UQ	< 0.0412	< 0.0381	< 0.194	< 0.0381	< 0.0404	< 0.0388	< 0.192	< 0.510	< 0.255
Fluoranthene	µg/L		14	0.2	0.0921 J	0.0713 J	< 0.0381	0.21 J	0.0578 J	< 0.0404	< 0.0388	< 0.192	< 0.510	0.093
Fluorene	µg/L		390	0.0018	< 0.0467	< 0.0412	< 0.0381	< 0.194	< 0.0381	< 0.0404	< 0.0388	< 0.192	< 0.510	< 0.255
Indeno(1,2,3-cd)pyrene	µg/L		1	0.0018	< 0.467 UQ	< 0.0412	< 0.0381	< 0.194	< 0.0381	< 0.0404	< 0.0388	< 0.192	< 0.510	< 0.255
Naphthalene	µg/L			0.2	< 0.0935	< 0.0825	< 0.0762	< 0.388	< 0.0762	< 0.0808	< 0.0777	< 0.385		< 0.196
Pentachlorophenol	µg/L		20	0.56	< 1.17	1.09 J	< 0.952	< 4.85	< 0.952	< 1.01	< 0.971	< 1.92	< 2.04	0.891
Phenanthrene	µg/L			0.2	0.0991	0.0503 J	< 0.0381	0.22 J	< 0.0381	< 0.0404	0.0443 J	< 0.192		0.071
Pyrene	µg/L		290	0.2	0.0886 J	0.0588 J	< 0.0381	0.253 J	0.0553 J	0.0422 J	0.041 J	< 0.192	< 0.510	0.101
Total PAHs	µg/L				0.3519	1.2704	< 0.0381	0.683	0.1131	0.0422	0.0853	< 0.192	< 0.510	0.844
Phthalates														
Benzyl butyl phthalate	µg/L			3	< 7.01	< 6.19	< 5.71	< 29.1	< 5.71	< 6.06	< 5.83	< 28.8		< 14.7
Bis(2-ethylhexyl)phthalate	µg/L			0.22	< 5.14	< 4.54	< 4.19	30.2 J	< 4.19	4.79 J	< 4.27	< 21.2		7.09
Dibutyl Phthalate	µg/L			3	< 7.01	< 6.19	< 5.71	< 29.1	< 5.71	< 6.06	< 5.83	< 28.8		< 14.7
Diethyl Phthalate	µg/L			3	< 7.01	< 6.19	< 5.71	< 29.1	< 5.71	< 6.06	< 5.83	< 28.8		< 14.7
Dimethylphthalate	µg/L			3	< 7.01	< 6.19	< 5.71	< 29.1	< 5.71	< 6.06	< 5.83	< 28.8		< 14.7
Di-n-octyl phthalate	µg/L			3	< 70.1 UQ	< 6.19	< 5.71	< 29.1	< 5.71	< 6.06	< 5.83	< 28.8		< 35.05
Cyanide and Nitrite +Nitrate as N														
Cyanide, Free	µg/L		22	5.2			< 5.00	< 2.00	< 5.00	< 5.00	< 5.00	< 5.00	< 5.00	< 2.5
Cyanide, Total	µg/L				< 5.00	< 5.00	< 5.00	< 5.00				13.5		4.70
Nitrite + Nitrate as N	µg/L	680			260	280	310	400	40	70	60	340	690	272.2
Oil and Grease, Total Suspended Solids, and Turbidity														
pH	SU	5.5 - 9.0			6.86		7.39	7.7		7.13	7.17	6.83		7.2
HEM Oil & Grease	µg/L	10000			< 4670 UQ	< 5000	< 4760	< 5000	< 4850	< 4850	< 4810	< 4760	< 4850	< 2715
Total suspended solids	µg/L	100000			16000	11000	8000	79000	5000	32000	7000	59000	6000	24778
Turbidity	NTU				19		14	99	13	31	20	35		33.0

Notes:
Empty cells = Not analyzed
µg/L = micrograms per liter
DGI/NPDES = Data Gaps Investigation and/or NPDES sampling event
NA = Average influent and average effluent results are ND and therefore calculated removal efficiencies cannot be derived.
ND = All individual results included in arithmetic average calculation are below the detection limit.
NPDES = National Pollutant Discharge Elimination Scheme
NS = No Standard
NTU = nephelometric turbidity units
< = Compound not detected. Reportable detection limit shown.
[1] = Values are representative of arithmetic averages of each sample with half the method detection limits assumed as concentrations of compounds not detecte

Groundwater Pathway Criteria, *Draft Portland Harbor RI/FS Draft Final Feasibility Study Report* (USEPA June 2015)
Indicates result exceeds Portland Harbor RI/FS Draft Final Feasibility Study Report Preliminary Remediation Goal
Indicates result exceeds NPDES Reference Concentration
Indicates result exceeds NPDES Benchmark

Qualifiers - Organic:
J = The analyte was positively identified; associated numerical value is the approximate concentration of the analyte in the sample.
RL but > or = to the
Q = Uncertain Value
UQ = The result was qualified as a non-detected at the listed concentration due to an estimated maximum possible concentration.

Qualifiers - Inorganic:
J = The analyte was positively identified; associated numerical value is the approximate concentration of the analyte in the sample.
Q = Uncertain Value

Table 2
Electrocoagulation System Pilot Study Analytical Results
Storm Water Source Control Measure Design Update
Storm Water Source Control Measures
Vigor Industrial, LLC

				Outfall	OUTFALL Q - Post EC								EC System	
				Date	5/2/2013	1/7/2014	2/19/2014	3/28/2014	4/23/2014	6/12/2014	7/23/2014	Average[1]	Reduction of Average Concentration	Removal Efficiency
				Sample Type	PS	DGI/NPDES	PS	PS	PS	DGI/NPDES	DGI/NPDES			
				Sample ID	EC_FILTERED_050213	JTFALL Q-POST EC 1/7	TFALL Q-POST EC 2/19	all Q-POST EC 0328201	Outfall Q-POST EC 04232014	TFALL- Q POST EC -061	SW #3 Post-EC			
Analyte	Unit	NPDES Benchmark	NPDES Reference Concentration	JSCS SLV										
Metals														
Aluminum	µg/L	750		200	729	310	237	553	230	56.7	89.8	315	239	43%
Arsenic	µg/L			0.045	0.184	0.195	< 1.00	0.204	0.327	< 1.00		0.318	1.227	79%
Cadmium	µg/L			0.094	0.0556 J	< 0.0400	< 0.200	< 0.200	< 0.200	< 0.200	< 0.0400	0.071	0.510	88%
Chromium	µg/L			100	< 2.00	1.28	< 1.00	< 1.00	< 1.00	< 1.00	< 0.400	0.64	4.80	88%
Copper	µg/L	20		2.7	10.2	13.1	1.81	4.07	7.23	3.39	2.53 J	6.0	112.2	95%
Iron	µg/L	1000			262	1810	< 50.0	99.8	433	83.3	202	416	3528	89%
Lead	µg/L	40		0.54	< 1.00	0.322	< 0.200	< 0.200	< 0.200	< 0.200	0.211	0.20	11.21	98%
Mercury	µg/L			0.77	< 0.050	< 0.050	< 0.050	< 0.05	< 0.05	< 0.050		< 0.0045	0.03	88%
Nickel	µg/L			16	7.09	3.38	< 1.00	< 1.00	< 1.00	< 1.00	0.933 J	1.91	5.33	74%
Selenium	µg/L			5	< 2.00	< 0.500	< 1.00	< 1.00	< 1.00	< 1.00		< 0.1818	0.45	71%
Zinc	µg/L	120		36	58.6	150	32	22.9	115	17.1	31.3	61.0	1992.2	97%
Tributyltin	µg/L			0.072	< 0.050	< 0.0050	< 0.0050	< 0.005	0.33	0.017		0.06	0.01	19%
PCBs														
Aroclor 1016	µg/L			0.96	< 0.0109	< 0.00980	< 0.00980	< 0.0100	< 0.0102	< 0.196	< 0.00962	< 0.0178	NA	NA
Aroclor 1221	µg/L			0.034	< 0.0109	< 0.00980	< 0.00980	< 0.0100	< 0.0102	< 0.196	< 0.00962	< 0.0178	NA	NA
Aroclor 1232	µg/L			0.034	< 0.0109	< 0.00980	< 0.00980	< 0.0100	< 0.0102	< 0.196	< 0.0240	< 0.0178	NA	NA
Aroclor 1242	µg/L			0.034	< 0.0109	< 0.00980	< 0.00980	< 0.0100	< 0.0102	< 0.196	< 0.0192	< 0.0178	NA	NA
Aroclor 1248	µg/L			0.034	< 0.0109	< 0.00980	< 0.00980	< 0.0100	< 0.0102	< 0.196	< 0.0192	< 0.0178	-0.0046	-35%
Aroclor 1254	µg/L			0.034	< 0.0109	< 0.00980	< 0.00980	< 0.0100	< 0.0102	< 0.196	< 0.0192	< 0.0178	NA	NA
Aroclor 1260	µg/L			0.034	< 0.0109	< 0.00980	< 0.00980	< 0.0100	< 0.0102	< 0.196	< 0.00962	< 0.0178	-0.0055	-45%
Aroclor 1262	µg/L				< 0.0109	< 0.00980	< 0.00980	< 0.0100	< 0.0102	< 0.196		< 0.0178	NA	NA
Aroclor 1268	µg/L				< 0.0109	< 0.00980	< 0.00980	< 0.0100	< 0.0102	< 0.196		< 0.0178	NA	NA
Total PCBs	µg/L		2	0.0000064	< 0.0109	< 0.0098	< 0.0098	< 0.01	< 0.0102	< 0.196	< 0.0192	< 0.0178	0.0104	37%
Pesticides														
4,4-DDE	µg/L		0.01	0.000022		< 0.00467	< 0.00495	< 0.00481	< 0.00505	< 0.00490	< 0.00495	< 0.0005	NA	NA
4,4-DDT	µg/L		1.1	0.000022	< 0.0319	< 0.0280	< 0.0297	< 0.0288	< 0.0303	< 0.0294	< 0.0297	< 0.0029	NA	NA
Aldrin	µg/L		3	0.000005	< 0.0319	< 0.0280	< 0.0297	< 0.0288	< 0.0303	< 0.0294	< 0.0297	< 0.0029	NA	NA
alpha-Chlordane	µg/L			0.000081	< 0.0319	< 0.0280	< 0.0297	< 0.0288	< 0.0303	< 0.0294	< 0.0297	< 0.0029	NA	NA
Chlordane, Technical	µg/L		2.4	0.000081	< 0.394	< 0.346	< 0.366	< 0.356	< 0.374	< 0.363	< 0.366	< 0.0358	NA	NA
Dieldrin	µg/L		0.24	0.0000054	< 0.0213	< 0.0187	< 0.0198	< 0.0192	< 0.0202	< 0.0196	< 0.0198	< 0.0019	NA	NA
gamma-Chlordane	µg/L		2.4	0.000081	< 0.0319	< 0.0280	< 0.0297	< 0.0288	< 0.0303	< 0.0294	< 0.0297	< 0.0029	NA	NA
Hexachlorobenzene	µg/L		1	0.000029	< 0.0213	< 0.0187	< 0.0198	< 0.0192	< 0.0202	< 0.0196	< 0.0198	< 0.0019	NA	NA
Polycyclic Aromatic Hydrocarbons														
1-Methylnaphthalene	µg/L				< 0.0860	< 0.392	< 0.0769	< 0.0200	< 0.0769	< 0.190		< 0.036	NA	NA
2-Methylnaphthalene	µg/L				< 0.0860	< 0.392	< 0.0769	< 0.0200	< 0.0769	< 0.190		< 0.036	NA	NA
Acenaphthene	µg/L		95	99	< 0.0430	< 0.196	< 0.0385	< 0.0100	< 0.0385	< 0.0952	< 0.481	< 0.044	NA	NA
Acenaphthylene	µg/L			0.2	< 0.0430	< 0.196	< 0.0385	< 0.0100	< 0.0385	< 0.0952		< 0.018	NA	NA
Anthracene	µg/L		2900	0.2	< 0.0430	< 0.196	< 0.0385	< 0.0100	< 0.0385	< 0.0952	< 0.481	< 0.044	NA	NA
Benzo(a)anthracene	µg/L		1	0.0018	< 0.0430	< 0.196	< 0.0385	< 0.0100	< 0.0385	< 0.0952	< 0.481	< 0.044	NA	NA
Benzo(a)pyrene	µg/L		1	0.0018	< 0.0645	< 0.294	< 0.0577	< 0.0150	< 0.0577	< 0.143	< 0.481	< 0.044	NA	NA
Benzo(b)fluoranthene	µg/L		1	0.0018	< 0.0645	< 0.294	< 0.0577	< 0.0150	< 0.0577	< 0.143	< 0.481	< 0.044	NA	NA
Benzo(g,h,i)perylene	µg/L			0.2	< 0.0430	< 0.196	< 0.0385	< 0.0100	< 0.0385	< 0.0952		< 0.018	NA	NA
Benzo(k)fluoranthene	µg/L		1	0.0018	< 0.0645	< 0.294	< 0.0577	< 0.0150	< 0.0577	< 0.143	< 0.481	< 0.044	NA	NA
Chrysene	µg/L		1	0.0018	< 0.0430	< 0.196	< 0.0385	< 0.0100	< 0.0385	< 0.0952	< 0.481	< 0.044	0.036	45%
Dibenzo(a,h)anthracene	µg/L		1	0.0018	< 0.0430	< 0.196	< 0.0385	< 0.0100	< 0.0385	< 0.0952	< 0.481	< 0.044	NA	NA
Fluoranthene	µg/L		14	0.2	< 0.0430	< 0.196	< 0.0385	< 0.0100	< 0.0385	< 0.0952	< 0.481	< 0.044	0.050	53%
Fluorene	µg/L		390	0.0018	< 0.0430	< 0.196	< 0.0385	< 0.0100	< 0.0385	< 0.0952	< 0.481	< 0.044	NA	NA
Indeno(1,2,3-cd)pyrene	µg/L		1	0.0018	< 0.0430	< 0.196	< 0.0385	< 0.0100	< 0.0385	< 0.0952	< 0.481	< 0.044	NA	NA
Naphthalene	µg/L			0.2	< 0.0860	< 0.392	< 0.0769	< 0.0200	< 0.0769	< 0.190		< 0.036	NA	NA
Pentachlorophenol	µg/L		20	0.56	< 1.08	< 4.90	< 0.962	< 0.250	< 0.962	< 0.952	< 1.92	< 0.445	0.446	50%
Phenanthrene	µg/L			0.2	0.0459 J	< 0.196	< 0.0385	0.0187 J	< 0.0385	< 0.0952		0.041	0.030	42%
Pyrene	µg/L		290	0.2	< 0.0430	< 0.196	< 0.0385	< 0.0100	< 0.0385	< 0.0952	< 0.481	< 0.044	0.057	57%
Total PAHs	µg/L				0.0459	< 0.196	< 0.0385	0.0187	< 0.0385	< 0.0952	< 0.481	0.261	0.583	69%
Phthalates														
Benzyl butyl phthalate	µg/L			3	< 6.45	< 29.4	< 5.77	< 1.50	< 0.0577	< 14.3		< 2.67	NA	NA
Bis(2-ethylhexyl)phthalate	µg/L			0.22	< 4.73	< 21.6	< 4.23	< 1.10	< 4.23	< 10.5		< 1.96	5.13	72%
Dibutyl Phthalate	µg/L			3	8.65 J	< 29.4	< 5.77	< 1.50	< 0.0577	< 14.3		5.69	NA	NA
Diethyl Phthalate	µg/L			3	< 6.45	< 29.4	< 5.77	< 1.50	< 0.0577	< 14.3		< 2.67	NA	NA
Dimethylphthalate	µg/L			3	< 6.45	< 29.4	< 5.77	< 1.50	< 0.0577	< 14.3		< 2.67	NA	NA
Di-n-octyl phthalate	µg/L			3	< 6.45	< 29.4	< 5.77	< 1.50	< 0.0577	< 14.3		< 2.67	NA	NA
Cyanide and Nitrite +Nitrate as N														
Cyanide, Free	µg/L		22	5.2		< 2.00	< 5.00	< 5.00	< 5.00	< 5.00	< 5.00	< 0.45	NA	NA
Cyanide, Total	µg/L				< 5.00	< 5.00				12.1		5.70	-1.00	-21%
Nitrite + Nitrate as N	µg/L	680			270	320	60	170	130	170	230	192.9	79.4	29%
Oil and Grease, Total Suspended Solids, and Turbidity														
pH	SU	5.5 - 9.0				6.5		8.19	8.66	7.41		7.7	-0.5	-7%
HEM Oil & Grease	µg/L	10000			< 5430	< 5150	< 4810	< 5000	< 4950	< 5000	< 4900	< 494	NA	NA
Total suspended solids	µg/L	100000			< 5000	< 5000	< 5000	< 5000	< 5000	< 5000	< 5000	< 455	24323	98%
Turbidity	NTU				0.27	2.4	0.19	0.34	1.2	0.19		0.8	32.2	98%

Notes:
Empty cells = Not analyzed
µg/L = micrograms per liter
DGI/NPDES = Data Gaps Investigation and/or NPDES sampling event
NA = Average influent and average effluent results are ND and therefore calculated removal efficiencies cannot be derived.
ND = All individual results included in arithmetic average calculation are below the detection limit.
NPDES = National Pollutant Discharge Elimination Scheme
NS = No Standard
NTU = nephelometric turbidity units
< = Compound not detected. Reportable detection limit shown.
[1] = Values are representative of arithmetic averages of each sample with half the method detection limits assumed as concentratior

Indicates result exceeds JSCS SLV
Indicates result exceeds NPDES Reference Concentration
Indicates result exceeds NPDES Benchmark

Qualifiers - Organic:
J = The analyte was positively identified; associated numerical value is the approximate concentration of the analyte in the sample.
RL but > or = to the
Q = Uncertain Value
UQ = The result was qualified as a non-detected at the listed concentration due to an estimated maximum possible concentration.

Qualifiers - Inorganic:
J = The analyte was positively identified; associated numerical value is the approximate concentration of the analyte in the sample.
Q = Uncertain Value

Table 3
Grattix Box Downspout Treatment Pilot Study Analytical Results
Storm Water Source Control Measure Design Update
Storm Water Source Control Measures
Vigor Industrial, LLC

Analyte	Unit	NPDES Benchmark	NPDES Reference Concentration	Surface Water PRG	Influent-092414 9/24/2014	Influent-120914 12/9/2014	Influent 101514 10/15/2014	Grattix Box -Pre 11/21/2014	Influent-012315 1/23/2015	Influent-020515 2/5/2015	Influent-032315 3/23/2015	Average Influent	Effluent-092414 9/24/2014	Effluent-120914 12/9/2014	Effluent 101514 10/15/2014	Grattix Box-Post 11/21/2014	Effluent-012315 1/23/2015	Effluent-020515 2/5/2015	Effluent-032315 3/23/2015	Average Effluent	Reduction of Average Concentration	Removal Efficiency
Metals																						
Aluminum	µg/L	750		NS	< 25.0	< 25.0	**151**	**143**	**83.6**	**59.8**	< 25.0	**73.2**	**398**	**79.1**	**287** Q-41	**129**	**1470**	**229**	**169**	**394.4**	-321.2	-439%
Arsenic	µg/L			0.018																	NA	NA
Cadmium	µg/L			0.09	**0.344**	**0.0667** J	**0.1** J	**0.189** J	**0.111** J	**0.167** J	< 0.0400	**0.145**	< 0.0400	< 0.0400	< 0.0400	< 0.0400	**0.0667** J	< 0.0400	< 0.0400	**0.044**	0.102	70%
Chromium	µg/L			100	**71.5**	**1.72**	**11.1**	**6.67**	**2.01**	**1.19**	**1.18** J	**13.62**	**49.4**	**1.46**	**3**	**1.27**	**2.76**	**0.878** J	**1.07** J	**8.55**	5.08	37%
Copper	µg/L	20		2.74	**27.7**	**5.42**	**43**	**29.8**	**25.1**	**16.6**	**2.39**	**21.43**	**5.02**	**1.16**	**2.7**	**2.46**	**6.77**	**7.21**	**1.89**	**3.89**	17.54	82%
Iron	µg/L	1000		NS	**114**	**73**	**409**	**350**	**182**	**172**	**53.4** J	**193.3**	**523**	**131**	**332**	**144**	**2270**	**281**	**192** J	**553.3**	-359.9	-186%
Lead	µg/L	40		0.54	**1.77**	**0.756**	**11.8**	**7.8**	**2.21**	**2.49**	**0.567**	**3.9**	**0.256**	< 0.100	**0.5**	**0.2**	**0.811**	**0.578**	< 0.100	**0.4**	3.5	91%
Mercury	µg/L			NS																	NA	NA
Nickel	µg/L			NS	**1.06**	< 0.500	**1.12**	**1.03**	< 0.500	< 0.500	< 0.500	**0.74**	**0.789** J	**0.633** J	< 0.500	< 0.500	**1.62** J	**0.822** J	< 0.500	**0.77**	-0.02	-3%
Selenium	µg/L			NS																	NA	NA
Zinc	µg/L	120		36.5	**5220**	**2170**	**1530**	**2840**	**3590**	**4730**	**1740**	**3117.1**	**7.24**	**20.6**	**6.26**	**7.82**	**73.5**	**160**	**56.9**	**47.5**	3069.7	98%
Tributyltin	µg/L			0.063																	NA	NA
PCBs																						
PCB-1016 (Aroclor 1016)	µg/L			0.0000064	< 0.0109	< 0.0104	< 0.0106	< 0.00952	< 0.0100	< 0.0116	< 0.0103	< 0.0058	< 0.00980	< 0.00952	< 0.0103	< 0.00952	< 0.0108	< 0.00990	< 0.00952	< 0.0054	NA	NA
PCB-1221 (Aroclor 1221)	µg/L			0.0000064	< 0.0109	< 0.0104	< 0.0106	< 0.00952	< 0.0100	< 0.0116	< 0.0103	< 0.0058	< 0.00980	< 0.00952	< 0.0103	< 0.00952	< 0.0108	< 0.00990	< 0.00952	< 0.0054	NA	NA
PCB-1232 (Aroclor 1232)	µg/L			0.0000064	< 0.0109	< 0.0104	< 0.0106	< 0.00952	< 0.0100	< 0.0116	< 0.0103	< 0.0058	< 0.00980	< 0.00952	< 0.0103	< 0.00952	< 0.0108	< 0.00990	< 0.00952	< 0.0054	NA	NA
PCB-1242 (Aroclor 1242)	µg/L			0.0000064	< 0.0109	< 0.0104	< 0.0106	< 0.00952	< 0.0100	< 0.0116	< 0.0103	< 0.0058	< 0.00980	< 0.00952	< 0.0103	< 0.00952	< 0.0108	< 0.00990	< 0.00952	< 0.0054	NA	NA
PCB-1248 (Aroclor 1248)	µg/L			0.0000064	< 0.0109	< 0.0104	< 0.0106	< 0.00952	< 0.0100	< 0.0116	< 0.0103	< 0.0058	< 0.00980	< 0.00952	< 0.0103	< 0.00952	< 0.0108	< 0.00990	< 0.00952	< 0.0054	NA	NA
PCB-1254 (Aroclor 1254)	µg/L			0.0000064	< 0.0109	< 0.0104	< 0.0106	< 0.00952	< 0.0100	< 0.0116	< 0.0103	< 0.0058	< 0.00980	< 0.00952	< 0.0103	< 0.00952	< 0.0108	< 0.00990	< 0.00952	< 0.0054	NA	NA
PCB-1260 (Aroclor 1260)	µg/L			0.0000064	< 0.0109	< 0.0104	< 0.0106	< 0.00952	< 0.0100	< 0.0116	< 0.0103	< 0.0058	< 0.00980	< 0.00952	< 0.0103	< 0.00952	< 0.0108	< 0.00990	< 0.00952	< 0.0054	NA	NA
PCB-1262 (Aroclor 1262)	µg/L			0.0000064	< 0.0109	< 0.0104	< 0.0106	< 0.00952				< 0.00545	< 0.00980	< 0.00952	< 0.0103	< 0.00952				< 0.00515	NA	NA
PCB-1268 (Aroclor 1268)	µg/L			0.0000064	< 0.0109	< 0.0104	< 0.0106	< 0.00952				< 0.00545	< 0.00980	< 0.00952	< 0.0103	< 0.00952				< 0.00515	NA	NA
Total PCBs	µg/L		2	0.0000065	< 0.0109	< 0.0104	< 0.0106	< 0.00952	< 0.01	< 0.0116	< 0.0103	< 0.0058	< 0.0098	< 0.00952	< 0.0103	< 0.00952	< 0.0108	< 0.0099	< 0.00952	< 0.0054	NA	NA
Pesticides																						
4,4'-DDE	µg/L		0.01	0.000031	< 0.00481	< 0.00476	< 0.00515	< 0.00515	< 0.00485	< 0.00556	< 0.00515	< 0.00278	< 0.00485	< 0.00481	< 0.00472	< 0.00490	< 0.00485	< 0.00481	0.0133[2] P-01	< 0.00245	NA	NA
4,4'-DDT	µg/L		1.1	0.000022	< 0.0288	< 0.0286	< 0.0309	< 0.0309	< 0.0291	< 0.0333	< 0.0309	< 0.01665	< 0.0291	< 0.0288	< 0.0283	< 0.0294	< 0.0291	< 0.0288	< 0.0286	< 0.0147	NA	NA
Aldrin	µg/L		3	0.000005	< 0.0288	< 0.0286	< 0.0309	< 0.0309	< 0.0291	< 0.0333	< 0.0333	< 0.01665	< 0.0291	< 0.0288	< 0.0283	< 0.0294	< 0.0291	< 0.0288	< 0.0286	< 0.0147	NA	NA
alpha-Chlordane	µg/L			0.000081	< 0.0288	< 0.0286	< 0.0309	< 0.0309				< 0.01545	< 0.0291	< 0.0288	< 0.0283	< 0.0294				< 0.0147	NA	NA
Chlordane	µg/L		2.4	0.000081	< 0.356	< 0.352	< 0.381	< 0.381	< 0.359	< 0.411	< 0.381	< 0.2055	< 0.359	< 0.356	< 0.349	< 0.363	< 0.359	< 0.356	< 0.352	< 0.1815	NA	NA
Dieldrin	µg/L		0.24	NS	< 0.0192	< 0.0190	< 0.0206	< 0.0206	< 0.0194	< 0.0222	< 0.0206	< 0.0111	< 0.0194	< 0.0192	< 0.0189	< 0.0196	< 0.0194	< 0.0192	< 0.0190	< 0.0098	NA	NA
gamma-Chlordane	µg/L		2.4	0.000081	< 0.0288	< 0.0286	< 0.0309	< 0.0309				< 0.01545	< 0.0291	< 0.0288	< 0.0283	< 0.0294				< 0.0147	NA	NA
Hexachlorobenzene	µg/L		1	0.000029	< 0.0192	< 0.0190	< 0.0206	< 0.0206	< 0.0194	< 0.0222	< 0.0206	< 0.0111	< 0.0194	< 0.0192	< 0.0189	< 0.0196	< 0.0194	< 0.0192	< 0.0190	< 0.0098	NA	NA
Polycyclic Aromatic Hydrocarbons																						
1-Methylnaphthalene				NS																		
2-Methylnaphthalene	µg/L			2.1																		
Acenaphthene	µg/L		95	23	< 1.00	< 0.789	< 0.806	< 0.102	< 0.980	< 0.852	< 0.789	< 0.5	< 0.990	< 0.962	< 0.971	< 0.0962	< 0.962	< 0.952	< 0.952	< 0.495	NA	NA
Acenaphthylene	µg/L			NS																		
Anthracene	µg/L		2900	0.73	< 1.00	< 0.789	< 0.806	< 0.102	< 0.980	< 0.852	< 0.789	< 0.5	< 0.990	< 0.962	< 0.971	< 0.0962	< 0.962	< 0.952	< 0.952	< 0.495	NA	NA
Benzo(a)anthracene	µg/L		1	0.0013	< 1.00	< 0.789	< 0.806	< 0.102	< 0.980	< 0.852	< 0.789	< 0.5	< 0.990	< 0.962	< 0.971	< 0.0962	< 0.962	< 0.952	< 0.952	< 0.495	NA	NA
Benzo(a)pyrene	µg/L		1	0.0013	< 1.00	< 0.789	< 0.806	< 0.153	< 0.980	< 0.852	< 0.789	< 0.5	< 0.990	< 0.962	< 0.971	< 0.144	< 0.962	< 0.952	< 0.952	< 0.495	NA	NA
Benzo(b)fluoranthene	µg/L		1	0.0013	< 1.00	< 0.789	< 0.806	< 0.153	< 0.980	< 0.852	< 0.789	< 0.5	< 0.990	< 0.962	< 0.971	< 0.144	< 0.962	< 0.952	< 0.952	< 0.495	NA	NA
Benzo(g,h,i)perylene	µg/L			0.44																		
Benzo(k)fluoranthene	µg/L		1	0.0013	< 1.00	< 0.789	< 0.806	< 0.153	< 0.980	< 0.852	< 0.789	< 0.5	< 0.990	< 0.962	< 0.971	< 0.144	< 0.962	< 0.952	< 0.952	< 0.495	NA	NA
Chrysene	µg/L		1	0.0013	< 1.00	< 0.789	< 0.806	< 0.102	< 0.980	< 0.852	< 0.789	< 0.5	< 0.990	< 0.962	< 0.971	< 0.0962	< 0.962	< 0.952	< 0.952	< 0.495	NA	NA
Dibenzo(a,h)anthracene	µg/L		1	0.0013	< 1.00	< 0.789	< 0.806	< 0.102	< 0.980	< 0.852	< 0.789	< 0.5	< 0.990	< 0.962	< 0.971	< 0.0962	< 0.962	< 0.952	< 0.952	< 0.495	NA	NA
Fluoranthene	µg/L		14	6.2	< 1.00	< 0.789	< 0.806	< 0.102	< 0.980	< 0.852	< 0.789	< 0.5	< 0.990	< 0.962	< 0.971	< 0.0962	< 0.962	< 0.952	< 0.952	< 0.495	NA	NA
Fluorene	µg/L		390	3.9	< 1.00	< 0.789	< 0.806	< 0.102	< 0.980	< 0.852	< 0.789	< 0.5	< 0.990	< 0.962	< 0.971	< 0.0962	< 0.962	< 0.952	< 0.952	< 0.495	NA	NA
Indeno(1,2,3-cd)pyrene	µg/L		1	0.0013	< 1.00	< 0.789	< 0.806	< 0.102	< 0.980	< 0.852	< 0.789	< 0.5	< 0.990	< 0.962	< 0.971	< 0.0962	< 0.962	< 0.952	< 0.952	< 0.495	NA	NA
Naphthalene	µg/L			12																		
Pentachlorophenol	µg/L		20	0.15	< 4.00	< 3.16	< 3.23	< 2.55	< 3.92	< 3.41	< 3.16	< 2	< 3.96	< 3.85	< 3.88	< 2.40	< 3.85	< 3.81	< 3.81	< 1.98	NA	NA
Phenanthrene	µg/L			0.63																		
Pyrene	µg/L		290	10	< 1.00	< 0.789	< 0.806	< 0.102	< 0.980	< 0.852	< 0.789	< 0.5	< 0.990	< 0.962	< 0.971	< 0.0962	< 0.962	< 0.952	< 0.952	< 0.495	NA	NA
Total PAHs	µg/L			NS	< 1	< 0.789	< 0.806	< 0.102	< 0.98	< 0.852	< 0.789	< 0.5	< 0.99	< 0.962	< 0.971	< 0.0962	< 0.962	< 0.952	< 0.952	< 0.495	NA	NA
Phthalates																						
Benzyl butyl phthalate	µg/L			NS																	NA	NA
Bis(2-ethylhexyl)phthalate	µg/L			0.2																	NA	NA
Dibutyl Phthalate	µg/L			NS																	NA	NA
Diethyl Phthalate	µg/L			NS																	NA	NA
Dimethylphthalate	µg/L			NS																	NA	NA
Di-n-octyl phthalate	µg/L			NS																	NA	NA
ASTM D4282-02																						
Cyanide, Free	µg/L		22	5.2	< 2.00	< 2.00	< 2.00	< 2.00	< 2.00	< 2.00	< 2.00	< 1	< 2.00	< 2.00	< 2.00	< 2.00	< 2.00	< 2.00	< 2.00	< 1	NA	NA
Cyanide, Total				NS																	NA	NA
Nitrite + Nitrate as N	µg/L	680		NS	**890**	**2200**	**40**	**90**	**120**	**90**	**30**	**494**	**860**	**150**	**150**	**120**	**310**	**390**	**170**	**307.1**	187.1	38%
EPA 150.1																						
pH	pH units	5.5 - 9.0		NS		**6.62**						**6.62**		**6.75**						**6.75**	-0.13	-2%
HEM Oil & Grease	µg/L	10000		NS	< 5490 O-01	< 5260	< 5380 O-01	< 5560	< 4810	< 5260	< 4760	< 2780	< 4810 O-01	< 5260	< 4850 O-01	< 5880	< 4810	< 4810	< 4950	< 2940	NA	NA
Total suspended solids	µg/L	100000		NS	< 5000	< 5000	**5000**	**10000**	< 5000	**8000**	< 5000	**6143**	**10000**	**6000**	< 5000	< 5000	**16000**	**9000**	< 5000	**8000**	-1857	-30%

Notes:
Empty cells = Not analyzed
µg/L = micrograms per liter
< = Compound not detected. Reportable detection limit shown.
DGI/NPDES = Data Gaps Investigation and/or NPDES sampling event
FD = Field Duplicate Sample
NA = Average influent and average effluent results are ND and therefore calculated removal efficiencies cannot be derived.
NS = No Standard
ND = All individual results included in arithmetic average calculation are below the detection limit.
NPDES = National Pollutant Discharge Elimination Scheme
PRG = Most stringent Preliminary Remediation Goal for Surface Water, *Draft Portland Harbor RI/FS Draft Final Feasibility St*

Groundwater Pathway Criteria, *Draft Portland Harbor RI/FS Draft Final Feasibility Study Report* (USEPA June 2015)
Indicates result exceeds PRG
Indicates result exceeds NPDES Reference Concentration
Indicates result exceeds NPDES Benchmark

Qualifiers - Organic:
J = The analyte was positively identified; associated numerical value is the approximate concentration of the analyte in the sample.
JQ = Result is < the RL but > or = to the MDL and the concentration is an approximate value; The isomer is qualified as positively identified, but at an estimated quantity because the quantitation is based on the theoretical ratio for these samples
Q = Uncertain Value
UQ = The result was qualified as a non-detected at the listed concentration due to an estimated maximum possible concentration.
Qualifiers - Inorganic:
J = The analyte was positively identified; associated numerical value is the approximate concentration of the analyte in the sample.
Q = Uncertain Value

[1] = Values are representative of arithmetic averages of each sample with method detection limits assumed as concentrations of compounds not detected.
[2] = Data considered suspect due to laboratory data qualification, not included in average calculation.

Table 4
Bioretention Pond Design Parameters and Bypass Flow Analysis
Storm Water Source Control Measure Design Update
Storm Water Source Control Measures
Vigor Industrial, LLC

Bioretention Pond Design Parameters				
Water Qualtiy Design Storm Size	1.25		inches	
Rainfall Distribution	IA 24-hr			
Bioretention Media Infiltration Rate	10		inches per hour	
Average Water Shed Surface Slope	0.005		ft/ft	
Total Area	38.05		Acres	
Total Design Storm Volume	1,063,902		gallons	
Minimum Design Treatment Flow Rate	1,455		gpm	
Peak Inflow	4604.688		gpm	
Peak Outflow	1,679		gpm	
Peak Elevation	36.95		ft NAVD88	
Peak Storage	106,553		gallons	
Pond Stage	Elevation		Storage	
Top of Biofiltration Media Elevation	36.00	ft NADV88	0	gallons
Overflow Riser Elevation	36.95	ft NADV88	112,744	gallons
Top of Berm Elevation	38.00	ft NADV88	242,759	gallons
Bypass Flow Analysis[1,2]				
Flow Volume	Total		Annual Average	
Total Runoff Volume	2,306,773,905	gallons	35,488,829	gallons
Treated Flow Volume	2,280,306,812	gallons	35,081,643	gallons
Outflow Q Weir Bypass Volume	8,861,859	gallons	136,336	gallons
Bioretention Pond High Flow Riser Bypass	17,605,234	gallons	270,850	gallons
Total Treated Flow	98.85	%	98.85	%
Outflow Q Weir Bypass	0.38	%	0.38	%
Bioretention Pond High Flow Riser Bypass	0.76	%	0.76	%

Notes

1 = Rainfall record 1948 through 2012 from Swan Island rain gauge (http://or.water.usgs.gov/non-usgs/bes/swan_island_pump.html)

2 = Bypass analysis assumes no evaporation or ex-filtration from bottom of bioretention pond

ft = feet

NAVD88 = North American Vertical Datum 1988

% = Percent

Table 5

Estimated Source Control Measure Technology Effectiveness
Storm Water Source Control Measure Design Update
Storm Water Source Control Measure
Vigor Industrial, LLC

Source Control Measure	Arsenic	Cadmium	Copper	Lead	Mercury[2]	Zinc	Tributyltin	BEHP	PCBs	Total PAHs
South Bioretention Pond SCM[1]	30%	70%	90%	90%	78%[2]	95%	78%[2]	78%[2]	78%[2]	78%[2]
EC System SCM	83%	85%	95%	98%	32%	97%	29%	60%	68%	96%
Individual roof drain Grattix box[1]	30%	70%	82%	91%	78%[2]	98%	78%[2]	78%[2]	78%[2]	78%[2]

Notes:

(grey)	Indicates performance data from high concentration and bioretention pond specific study (Davis et al 2003)
(green)	Indicates performance data from Grattix Box pilot study
(blue)	Indicates performance data from electrocoagulation pilot study

% = percent reduction from influent concentration

[1] = Performance data assumed to be equivalent to generic bioretention system from the International Stormwater BMP Database Pollutant Category Summary Statistical Addendum July 2012 where pilot study or performance data was unavailable

[2] = Removal efficiency assumed to be equivalent to total suspended solids removal performance

BEHP = Bis(2-Ethylhexyl)phthalate
PAH = Polynuclear Aromatic Hydrocarbon
PCB = Polychlorinated Biphenyl

Table 6
Estimated SCM Annual Mass Removal
Storm Water Source Control Measure Design Update
Storm Water Source Control Measures
Vigor Industrial, LLC

Source Control Measure			South Bioretention Pond SCM	EC System SCM	Individual Roof Drain Grattix Box Pilot Test	Parking Lot	Annual Total
Area		(acres)	36.6	17.4	1.8	6.6	62.4
Runoff Volume[1]		(gal)	33,918,771	16,070,199	1,685,750	6,122,422	57,797,141
Arsenic	Combined Influent Concentration	(µg/L)	1.18	1.14	0.45	1.27	--
	Influent Mass	(lbs)	0.0234	0.0106	0.0004	0.0045	0.0390
	Estimated Treatment Efficiency	%	30%	83%	30%	0%	--
	Estimated Effluent Concentration	(µg/L)	0.82	0.19	0.31	1.27	--
	Estimated Effluent Mass	(lbs)	0.016	0.002	0.000	0.005	0.023
	Estimated Mass Removal	(lbs)	0.0071	0.0088	0.0001	0.0000	0.0161
Cadmium	Combined Influent Concentration	(µg/L)	0.42	0.59	0.40	0.21	--
	Influent Mass	(lbs)	0.0082	0.0055	0.0004	0.0008	0.0149
	Estimated Treatment Efficiency	%	70%	85%	70%	0%	--
	Estimated Effluent Concentration	(µg/L)	0.12	0.09	0.12	0.21	--
	Estimated Effluent Mass	(lbs)	0.0025	0.0008	0.0001	0.0008	0.0042
	Estimated Mass Removal	(lbs)	0.0057	0.0047	0.0003	0.0000	0.0107
Copper	Combined Influent Concentration	(µg/L)	122	254	207	19	--
	Influent Mass	(lbs)	2.42	2.38	0.20	0.07	5.07
	Estimated Treatment Efficiency	%	90%	95%	82%	0%	--
	Estimated Effluent Concentration	(µg/L)	12	13	38	19	--
	Estimated Effluent Mass	(lbs)	0.24	0.12	0.04	0.07	0.47
	Estimated Mass Removal	(lbs)	2.17	2.26	0.17	0.00	4.60
Lead	Combined Influent Concentration	(µg/L)	25	21	15	2	--
	Influent Mass	(lbs)	0.491	0.201	0.014	0.007	0.713
	Estimated Treatment Efficiency	%	90%	98%	91%	0%	--
	Estimated Effluent Concentration	(µg/L)	2.49	0.43	1.32	1.87	--
	Estimated Effluent Mass	(lbs)	0.049	0.004	0.001	0.007	0.061
	Estimated Mass Removal	(lbs)	0.442	0.197	0.013	0.000	0.652
Mercury	Combined Influent Concentration	(µg/L)	0	0	0	0	--
	Influent Mass	(lbs)	0.00070	0.00037	0.00002	0.00009	0.00118
	Estimated Treatment Efficiency	%	78%	32%	78%	0%	--
	Estimated Effluent Concentration	(µg/L)	0	0	0	0	--
	Estimated Effluent Mass	(lbs)	0.00015	0.00025	0.00001	0.00009	0.00050
	Estimated Mass Removal	(lbs)	0.00054	0.00012	0.00002	0.00000	0.00068
Zinc	Combined Influent Concentration	(µg/L)	1115	714	3542	50	--
	Influent Mass	(lbs)	22.0	6.7	3.5	0.2	32.4
	Estimated Treatment Efficiency	%	95%	97%	98%	0%	--
	Estimated Effluent Concentration	(µg/L)	56	21	54	50	--
	Estimated Effluent Mass	(lbs)	1.10	0.20	0.05	0.18	1.53
	Estimated Mass Removal	(lbs)	20.9	6.5	3.4	0.0	30.8
Tributyltin	Combined Influent Concentration	(µg/L)	0.053	0.059	0.048	0.006	--
	Influent Mass	(lbs)	0.00104	0.00055	0.00005	0.00002	0.0017
	Estimated Treatment Efficiency	%	78%	29%	78%	0%	--
	Estimated Effluent Concentration	(µg/L)	0.012	0.042	0.010	0.006	--
	Estimated Effluent Mass	(lbs)	0.00023	0.00039	0.00001	0.00002	0.00065
	Estimated Mass Removal	(lbs)	0.00081	0.00016	0.00004	0.00000	0.00101
BEHP	Combined Influent Concentration	(µg/L)	5.9	6.2	4.0	1.8	--
	Influent Mass	(lbs)	0.117	0.058	0.004	0.006	0.185
	Estimated Treatment Efficiency	%	78%	60%	78%	0%	--
	Estimated Effluent Concentration	(µg/L)	1.3	2.5	0.9	1.8	--
	Estimated Effluent Mass	(lbs)	0.026	0.023	0.001	0.006	0.056
	Estimated Mass Removal	(lbs)	0.091	0.035	0.003	0.000	0.129
PCBs	Combined Influent Concentration	(µg/L)	0.047	0.112	0.005	0.005	--
	Influent Mass	(lbs)	0.000931	0.001052	0.000005	0.000017	0.002005
	Estimated Treatment Efficiency	%	78%	68%	78%	0%	--
	Estimated Effluent Concentration	(µg/L)	0.0	0.0	0.0	0.0	--
	Estimated Effluent Mass	(lbs)	0.000205	0.000337	0.000001	0.000017	0.000560
	Estimated Mass Removal	(lbs)	0.000726	0.000715	0.000004	0.000000	0.001445
Total PAHs	Combined Influent Concentration	(µg/L)	0.47	0.43	0.54	0.05	--
	Influent Mass	(lbs)	0.0092	0.0040	0.0005	0.0002	0.0140
	Estimated Treatment Efficiency	%	78%	96%	78%	0%	--
	Estimated Effluent Concentration	(µg/L)	0.10	0.02	0.12	0.05	--
	Estimated Effluent Mass	(lbs)	0.0020	0.0002	0.0001	0.0002	0.0025
	Estimated Mass Removal	(lbs)	0.0072	0.0038	0.0004	0.0000	0.0115

Notes
µg/L = micrograms per liter
gal = gallons
lbs = Pounds
% = Percent
SCM = Source Control Measure
1 = Based on average annual rainfall depth of 37.9 inches

Table 7
Source Control Evaluation and Performance Monitoring
Storm Water Source Control Measure Design Update
Storm Water Source Control Measures
Vigor Industrial, LLC

Outfall	NPDES Rep Outfall Group[1]	Current Activities Conducted in Drainage Zone	Proposed Source Control Action	Implementation Phase	Phase 3 Monitoring Location	NPDES Benchmark Analytes (4 x per yr)	Source Control Analytes (4 x per yr)	NPDES Impairment Pollutants (2 x per yr)
E	2	Covered painting and blasting; roadway; craneway; administrative office space; parking lots; machinery and rolling stock repair and storage.	EC System SCM	Phase 5	Outfall E	pH, Al, Cd, Cu, Cr, Fe, Ni, Pb, Zn, O&G, TSS, Nitrate/Nitrite,	As, Hg, BEHP, PAH, PCB, TBT	Aldrin, DDT, DDE, Dieldrin, Chlordane, Cyanide, Hexachlorobenzene, PCP
G	1	Crane- and roadways; material laydown area (metal, wood, trailers).	EC System SCM	Phase 5	Outfall G	pH, Al, Cd, Cu, Cr, Fe, Ni, Pb, Zn, O&G, TSS, Nitrate/Nitrite,	As, Hg, BEHP, PAH, PCB, TBT	Aldrin, DDT, DDE, Dieldrin, Chlordane, Cyanide, Hexachlorobenzene, PCP
L	6	Fiber optic cable and miscellaneous equipment storage for Tyco vessel Global Sentinel at B304; parking, rail-, crane- and roadways; steel laydown.	South Bioretention Pond SCM	Phase 4	Outfall L	pH, Al, Cd, Cu, Cr, Fe, Ni, Pb, Zn, O&G, TSS, Nitrate/Nitrite,	As, Hg, BEHP, PAH, PCB, TBT	Aldrin, DDT, DDE, Dieldrin, Chlordane, Cyanide, Hexachlorobenzene, PCP
*M	4	Rail- and roadways; steel fabrication; indoor/covered coating; parts cleaning; outside materials storage; vehicle traffic; indoor paint/solvent storage.	Interim BMPs and treatment measures, follow by South Bioretention Pond SCM	Phase 3	Bioretention Pond Effluent Monitoring Vault	pH, Al, Cd, Cu, Cr, Fe, Ni, Pb, Zn, O&G, TSS, Nitrate/Nitrite,	As, Hg, BEHP, PAH, PCB, TBT	Aldrin, DDT, DDE, Dieldrin, Chlordane, Cyanide, Hexachlorobenzene, PCP
*O	4	Main roadways - heavy vehicle traffic; steel fabrication, stainless steel fabrication; welding; administrative offices.	Interim BMPs and treatment measures, follow by South Bioretention Pond SCM	Phase 3	Bioretention Pond Effluent Monitoring Vault	pH, Al, Cd, Cu, Cr, Fe, Ni, Pb, Zn, O&G, TSS, Nitrate/Nitrite,	As, Hg, BEHP, PAH, PCB, TBT	Aldrin, DDT, DDE, Dieldrin, Chlordane, Cyanide, Hexachlorobenzene, PCP
*P	5	Employee parking lot.	Additional Monitoring	--	Outfall P Upstream Manhole Influent	--	Al, As, Cd, Cu, Cr, Fe, Ni, Pb, Zn, Hg, BEHP, PAH, PCB, TBT	--
Q	4	Parking lots and roadways; administrative offices; central utility boiler; indoor/covered painting and blasting; covered, secured and bermed 90-day hazardous waste storage area; facility materials recycling, transfer and consolidation area; main paint/solvent	EC is Interim SCM followed by South Bioretention Pond SCM	Phase 3	Bioretention Pond Effluent Monitoring Vault	pH, Al, Cd, Cu, Cr, Fe, Ni, Pb, Zn, O&G, TSS, Nitrate/Nitrite,	As, Hg, BEHP, PAH, PCB, TBT	Aldrin, DDT, DDE, Dieldrin, Chlordane, Cyanide, Hexachlorobenzene, PCP
S	3	Roadway; parking; steam/pressure washing equipment machinery repair.	EC System SCM	Phase 5	Outfall S	pH, Al, Cd, Cu, Cr, Fe, Ni, Pb, Zn, O&G, TSS, Nitrate/Nitrite,	As, Hg, BEHP, PAH, PCB, TBT	Aldrin, DDT, DDE, Dieldrin, Chlordane, Cyanide, Hexachlorobenzene, PCP
LD-1B	5	Laydown area; abrasive blast grit storage and distribution; roadway.	EC System SCM	Phase 5	Outfall LD-1B	pH, Al, Cd, Cu, Cr, Fe, Ni, Pb, Zn, O&G, TSS, Nitrate/Nitrite,	As, Hg, BEHP, PAH, PCB, TBT	Aldrin, DDT, DDE, Dieldrin, Chlordane, Cyanide, Hexachlorobenzene, PCP

Notes:
* = Drainage basin information is for Cascade General owned property only; City of Portland owned property/catch basins are not included.
-- = Not Sampled
EQ = Exceedance Quotient
NPDES = National Pollutant Discharge Elimination System
SCM = Source Control Measure
SLV = Screening Level Value
SCSE = Source Control Screening Evaluation
EC = Electrocoagulation
O&G = Oil and Grease
TSS = Total Suspended Solids
PCB = Polychlorinated Biphenyl
PAH = Polynuclear Aromatic Hydrocarbon
PCP = Pentachlorophenol

Attachment A
Interim NPDES Tier II Source Control and Treatment Measure Layout

M:\Projects\Vigor_CascadeGeneral_Portland\maps\SW DG Report\Fig 1 NPDES_TierII_SCM_Layout.mxd Created By: Alex Kirk Date: 6/16/2015 Project: 0185794

Notes:
All subsurface features are approximate
Aerial Photo: City of Portland, July 2012

Environmental Resources Management
1001 SW 5th St, Suite 1010
Portland, Oregon 97204
ERM

Figure 1
Interim NPDES Tier II Source Control and Treatment Measure Layout
Vigor Industrial, LLC
Portland, Oregon

Attachment B
Storm Water Source Control Measure Phase 3 – Storm Water Reconveyance and Bioretention Pond Design Drawings

STORMWATER SOURCE CONTROL
PHASE 3 - BIORETENTION FACILITY IMPLEMENTATION
VIGOR INDUSTRIAL LLC
PORTLAND, OREGON

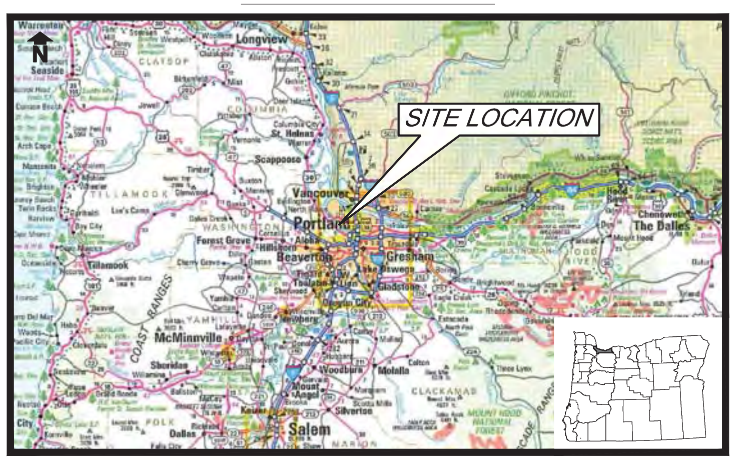
ISSUED FOR AGENCY APPROVAL
JUNE 2015

SITE LOCATION MAP

SOURCE MAP: U.S.G.S. QUADS PER ESRI

2000 1000 0 2000
SCALE IN FEET

SITE VICINITY MAP



SOURCE: RAND McNALLY, THE ROAD ATLAS 2002

PROJECT LOCATION
5555 N. CHANNEL AVE.
PORTLAND, OREGON 97217

LATITUDE: 45.565
LONGITUDE: -122.721

PROJECT DESCRIPTION
TAX LOTS R61740050, R61740100, R61740200, LOCATED IN THE SECTIONS 13 AND 18, TOWNSHIP 1 NORTH, RANGE 1 EAST AND RANGE 1 WEST, WILLAMETTE MERIDIAN, MULTNOMAH COUNTY, OREGON

PREPARED FOR
VIGOR INDUSTRIAL LLC

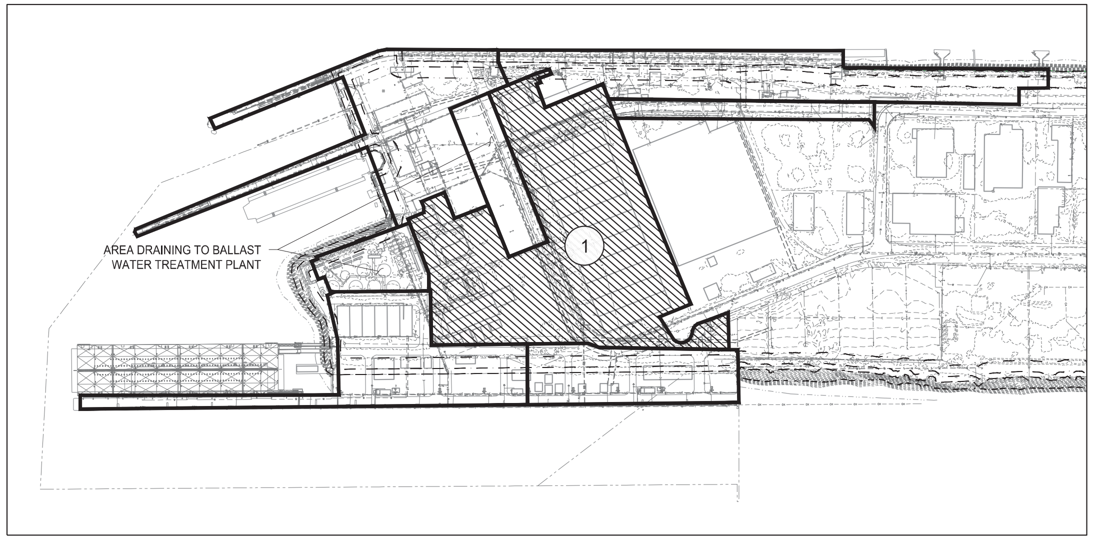
PREPARED BY

ERM
Environmental Resources Management
Portland, Oregon (503) 488-5282

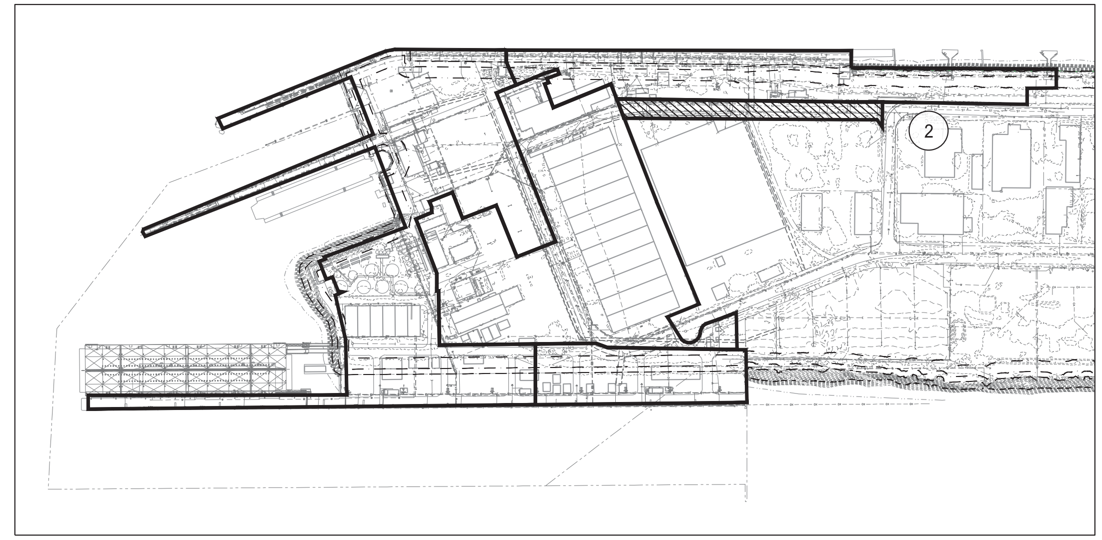
REGISTERED PROFESSIONAL ENGINEER
78496PE
OREGON
DECEMBER 31, 2007
BRENDAN ANDREW ROBINSON
EXP. 12/31/2016

DRAWING INDEX

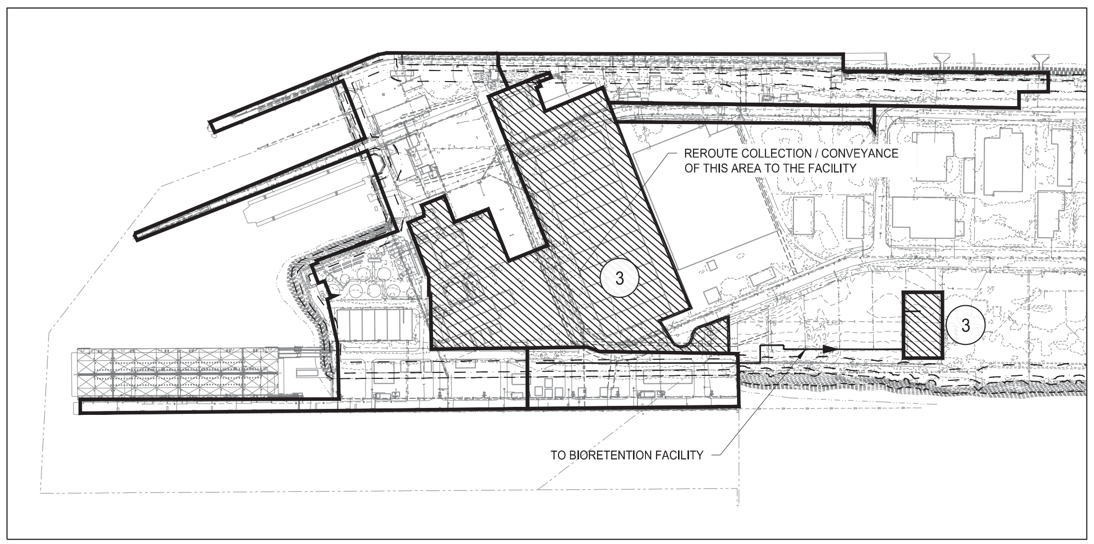
NOTES:
1. GRAY TEXT INDICATES DRAWINGS THAT ARE PART OF THE ENTIRE SOURCE CONTROL DESIGN BUT NOT RELEASED AS PART OF THIS SET.
2. PHASE 1 INCORPORATED INTO PHASE 3.



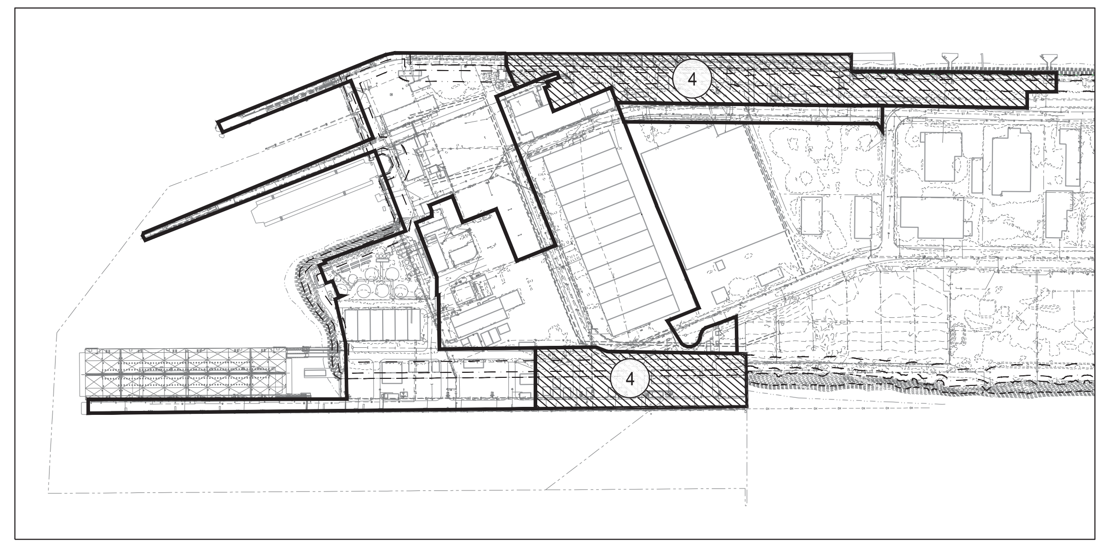
PHASE 1 - INCORPORATED INTO PHASE 3
STORMWATER COLLECTION/CONVEYANCE
(WINTER 2014)



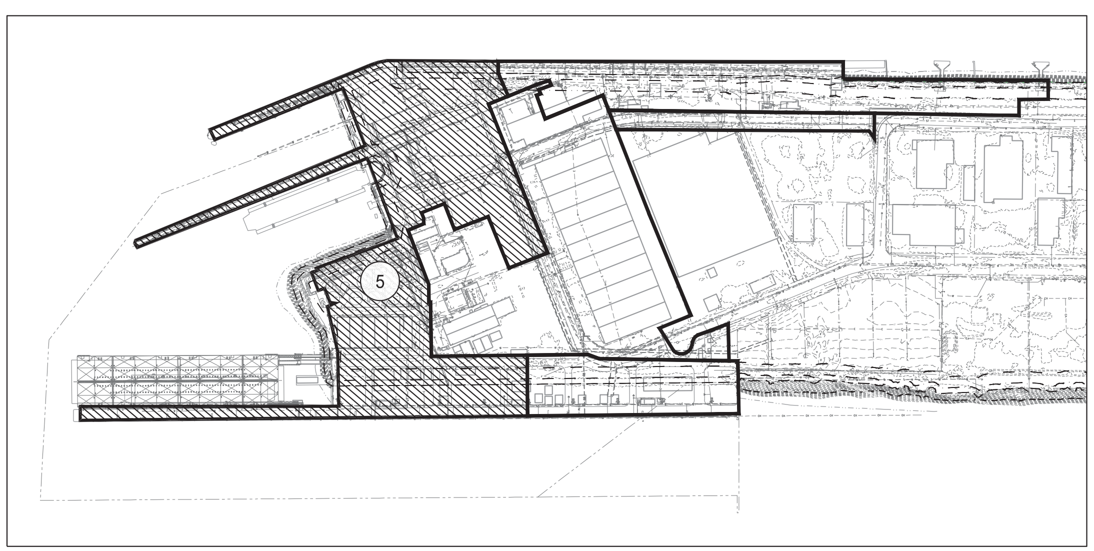
PHASE 2 - ON HOLD PENDING INTERIM MEASURE EVALUATION
NORTH LAGOON AVENUE BYPASS
(SPRING 2015)



PHASE 3
STORMWATER CONVEYANCE & BIORETENTION FACILITY IMPLEMENTATION
(FALL 2015)



PHASE 4
BERTH 303-305 AND 313-314 RECONVEYANCE
(SCHEDULE TO BE DETERMINED)



PHASE 5
ELECTROCOAGULATION SOURCE CONTROL MEASURE
(SCHEDULE TO BE DETERMINED)

LEGEND

EXISTING CONTOUR	FILTER SOCK
PROPOSED CONTOUR	SANITARY SEWER AND MANHOLE
EXISTING STORMWATER FEATURES AND FLOW DIRECTION ARROW	STORM SEWER AND MANHOLE
TAX LOTS	WATER LINE AND MANHOLE
PROPERTY BOUNDARY	ELECTRIC LINE
CITY OF PORTLAND UTILITY EASEMENT	GAS LINE
INDUSTRIAL OVERLAY ZONE OFFSET	UNIDENTIFIED UTILITY
GREENWAY SETBACK	COMPRESSED AIR LINE
TOP OF BANK / SEA WALL	NATURAL GAS LINE
ORDINARY HIGH WATER MARK	OIL LINE
LIMIT OF DISTURBANCE	OXYGEN LINE
ON-SITE TRAFFIC FLOW	STEAM LINE
WATER VALVE PIT	TELECOMMUNICATIONS LINE
STREET LIGHT	CATCH BASIN
HYDRANT	PROPOSED FORCEMAIN
	PROPOSED GRAVITY PIPE

GENERAL NOTES:

1. PLAN LOCATIONS AND DIMENSIONS SHALL BE STRICTLY ADHERED TO UNLESS OTHERWISE DIRECTED BY THE OWNER'S REPRESENTATIVE.
2. CONTRACTOR SHALL FIELD VERIFY EXISTING CONDITIONS AND DIMENSIONS PRIOR TO ORDERING AND/OR FABRICATION OF ANY MATERIALS.
3. CONTRACTOR SHALL BE SOLELY RESPONSIBLE FOR INITIATING, MAINTAINING AND SUPERVISING ALL SAFETY PRECAUTIONS AND PROGRAMS IN CONNECTION WITH THE WORK.
4. CONTRACTOR SHALL SUPERVISE AND DIRECT THE WORK. HE/SHE WILL BE SOLELY RESPONSIBLE FOR THE MEANS, METHODS, TECHNIQUES, PROCEDURES AND SEQUENCES, EXCEPT FOR THE OVERALL SEQUENCE OF CONSTRUCTION WHICH WILL BE CONDUCTED IN ACCORDANCE WITH THE SOIL EROSION & SEDIMENT CONTROL PLAN.
5. CONTRACTOR SHALL PATCH, REPAIR AND FINISH OR REPLACE ALL SURFACES, EQUIPMENT, OR FEATURES RESTORING SAID SURFACES, EQUIPMENT OR FEATURES DAMAGED DURING THE WORK TO THEIR PRE-WORK OR AS-DESIGNED CONDITION.
6. FABRICATION AND INSTALLATION OF ALL MATERIALS, FINISHES, ETC. SHALL BE IN ACCORDANCE WITH MANUFACTURER'S WRITTEN INSTRUCTIONS, UNLESS OTHERWISE SPECIFIED IN THE DESIGN
7. ALL CONSTRUCTION TO BE IN ACCORDANCE WITH LOCAL BUILDING CODES AND THE OREGON DEPARTMENT OF TRANSPORTATION ROAD AND BRIDGE STANDARDS UNLESS OTHERWISE SPECIFIED.
8. THE CONTRACTOR SHALL BE RESPONSIBLE FOR DETERMINING THE EXACT LOCATION OF UTILITIES, WHETHER SHOWN OR NOT SHOWN ON THE DRAWINGS, AND SHALL BE RESPONSIBLE FOR ALL COSTS INCURRED IN THE REPAIR OF ANY DAMAGE TO SAME RESULTING FROM THE CONTRACTOR'S WORK ASSOCIATED WITH THIS PROJECT. ANY DISCREPANCIES SHOULD BE REPORTED TO THE OWNER'S REPRESENTATIVE IMMEDIATELY.
9. THE CONTRACTOR SHALL TAKE ALL NECESSARY PRECAUTIONS TO PROTECT THE EXISTING UTILITIES AND MAINTAIN UNINTERRUPTED SERVICE AND ANY DAMAGE DONE TO THEM DUE TO HIS/HER NEGLIGENCE SHALL BE IMMEDIATELY AND COMPLETELY REPAIRED AT HIS/HER EXPENSE.
10. IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO ENSURE THERE IS SUFFICIENT COVER ON ALL PIPING DURING CONSTRUCTION TO PREVENT DAMAGE TO, OR FAILURE OF, PIPES.
11. ALL EXCAVATIONS SHALL BE KEPT DRY AT ALL TIMES UNLESS OTHERWISE NOTED.
12. ALL DIMENSIONS ARE TO CENTERLINE OF UTILITY UNLESS OTHERWISE NOTED.
13. THE CONTRACTOR SHALL OBTAIN THEIR OWN TRAILER AT NO EXTRA COST TO THE OWNER.
14. CONTRACTOR WILL BE RESPONSIBLE FOR OBTAINING ALL NECESSARY PERMITS REQUIRED FOR CONSTRUCTION PRIOR TO INITIATION OF WORK.
15. THESE PLANS ARE BASED ON INFORMATION AVAILABLE AT THE TIME THEY WERE PREPARED. ACTUAL CONDITIONS DETERMINED LATER MAY VARY. SOUND ENGINEERING JUDGMENT SHOULD BE EXERCISED DURING CONSTRUCTION TO ASSURE THAT THE DESIGN IS COMPATIBLE WITH THE ACTUAL CONDITIONS.
16. REFERENCE TO "OWNER" SHALL MEAN "VIGOR INDUSTRIAL".

TOPOGRAPHIC REFERENCES:

1. SURVEY AND DRAWING FILES OF UTILITIES, SITE INFRASTRUCTURE, ETC., COMBINED BY DAVID EVANS & ASSOCIATES, INC., PORTLAND, OREGON, DECEMBER 2013.
2. FIELD VERIFIED NOVEMBER 20, 2014 THAT CB 149 IS AN INLET THAT DRAINS TO MANHOLE AS INDICATED IN EXISTING CONDITIONS.
3. TOPOGRAPHIC SURVEY OF THE MAIN PARKING LOT CONDUCTED BY DAVID EVANS & ASSOCIATES, INC., PORTLAND, OREGON.
4. TOPOGRAPHIC MAPPING OF SURROUNDING AREAS GENERATED FROM USACE COLUMBIA RIVER LIDAR DATA, FLOWN 2010. THE TOPOGRAPHIC SURVEY HORIZONTAL DATUM IS OREGON STATE PLANES, NORTH ZONE, US FOOT, NAD 83 AND THE VERTICAL DATUM IS NAVD 88.
5. TOPOGRAPHIC SURVEY OF NORTH LAGOON AVE CONDUCTED BY DAVID EVANS & ASSOCIATES, INC., PORTLAND, OREGON, DECEMBER 2014.

PHASE SPECIFIC NOTE:

1. PHASE 2: TO BE DETERMINED WHETHER SCOPE OF WORK INCLUDES CAPTURE AND TREATMENT OF STREET RUNOFF. PROJECT SCOPE MAY BE LIMITED TO DISCONNECTING LATERALS THAT DRAIN OFF-STREET VIGOR INDUSTRIAL PROPERTY.
2. PHASE 4: WILL BE DETERMINED IF PROPOSED FORCEMAIN WILL BE BURIED OR SUSPENDED FROM DOCK STRUCTURE. HEAT TRACING WILL BE REQUIRED IF FORCEMAIN WILL BE INSTALLED ABOVE GRADE.

ABBREVIATIONS

AFF	ABOVE FINISHED FLOOR	I.E.	INVERT ELEVATION
BG	BELOW GRADE	LS	LIFT STATION
BLDG.	BUILDING	MAX.	MAXIMUM
BMP	BEST MANAGEMENT PRACTICE	MIN.	MINIMUM
CMP	CORRUGATED METAL PIPE	NOM.	NOMINAL
DEQ	STATE OF OREGON: DEPARTMENT OF ENVIRONMENTAL QUALITY	PVC	POLYVINYL CHLORIDE
DGA	DENSE GRADED AGGREGATE	REF.	REFERENCE
DIA.	DIAMETER	SCH	SCHEDULE
ELEV.	ELEVATION	SCM	SOURCE CONTROL MEASURE
ESCP	EROSION AND SEDIMENTATION CONTROL PLAN	TYP.	TYPICAL
FT.	FEET		

400 200 0 400
SCALE IN FEET

REGISTERED PROFESSIONAL ENGINEER
78496PE
OREGON
DECEMBER 31, 2002
BRENDAN ANDREW ROBINSON
EXP. 12/31/2016

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ERM

VIGOR INDUSTRIAL LLC
PHASE 3
CONVEYANCE & BIORETENTION FACILITY
PORTLAND **OREGON**

LEGEND

SCALE AS SHOWN | PROJECT NUMBER 0272376 | SHEET C-02 | REV.
DATE JUNE 25, 2015 | ISSUE AGENCY APPROVAL

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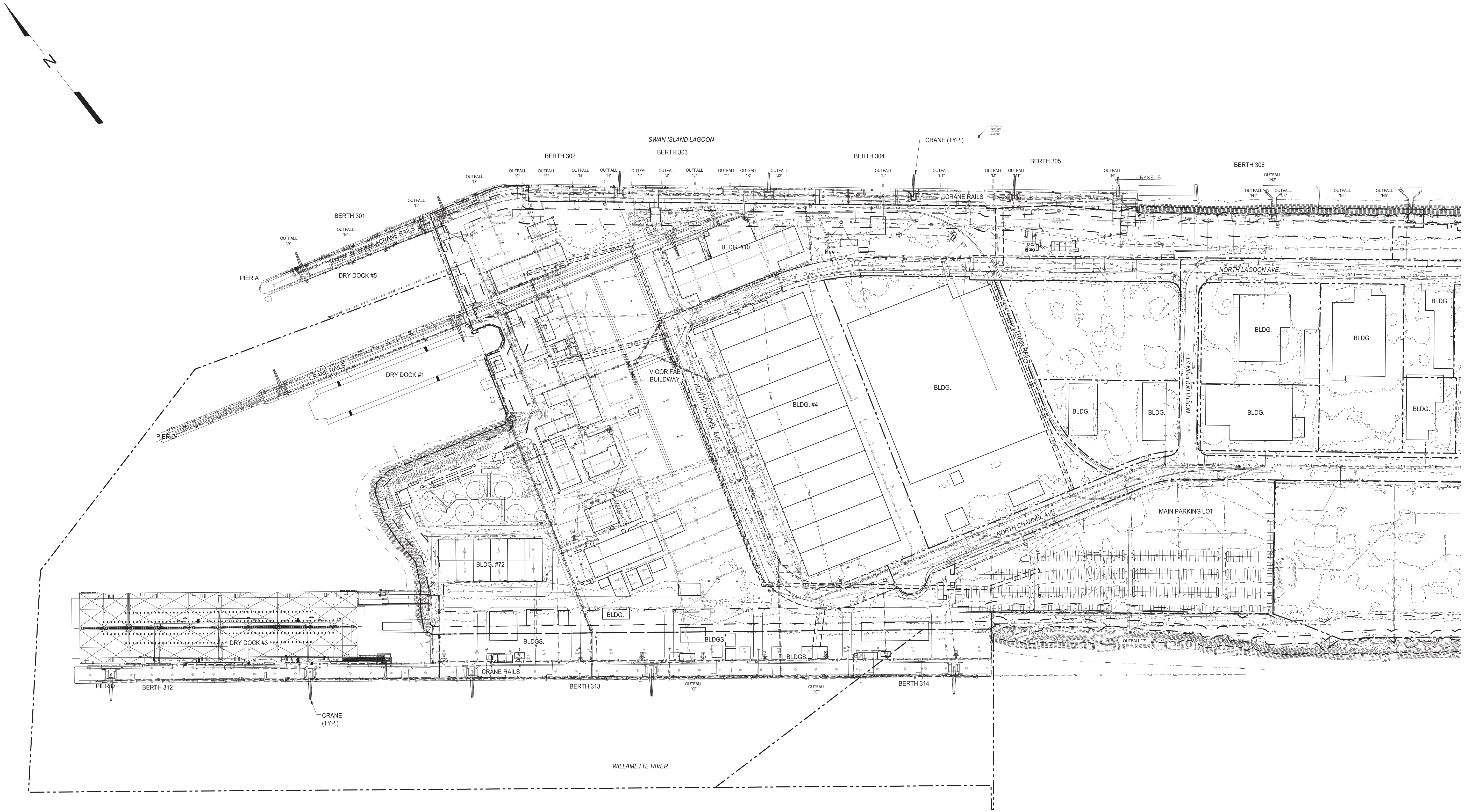

NOTE:

1. EXISTING EASEMENTS SHOWN.

150 75 0 150

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EXISTING CONDITIONS

SCALE	PROJECT NUMBER	SHEET	REV.
AS SHOWN	0272376	C-03	

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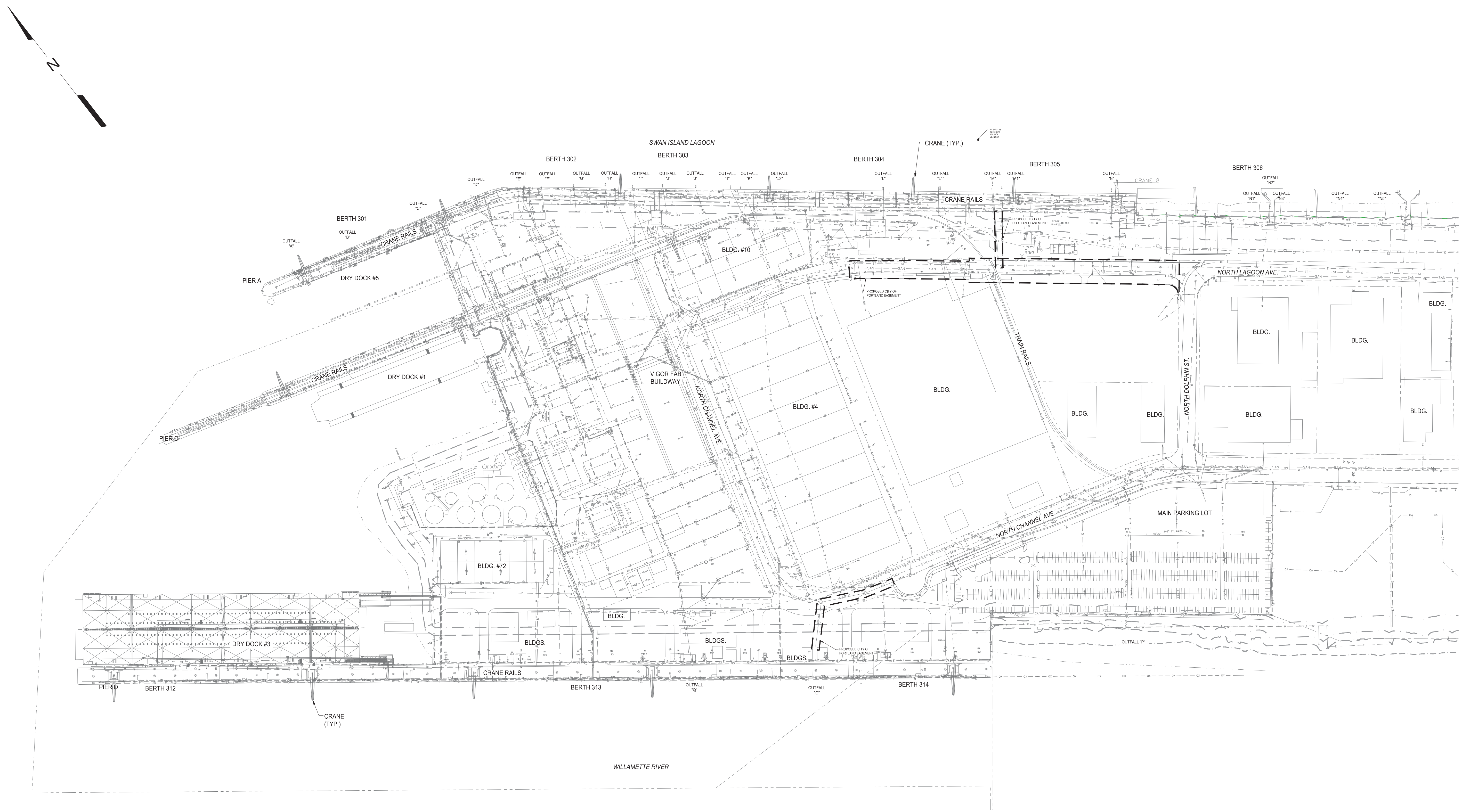

NOTE:

1. PROPOSED CITY OF PORTLAND EASEMENTS SHOWN.

150 75 0 150

SCALE IN FEET

REGISTERED PROFESSIONAL ENGINEER
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EXISTING CONDITIONS WITH PROPOSED CITY OF PORTLAND EASEMENTS

SCALE	PROJECT NUMBER	SHEET	REV.
AS SHOWN	0272376	C-03A	
DATE JUNE 25, 2015	ISSUE AGENCY APPROVAL		

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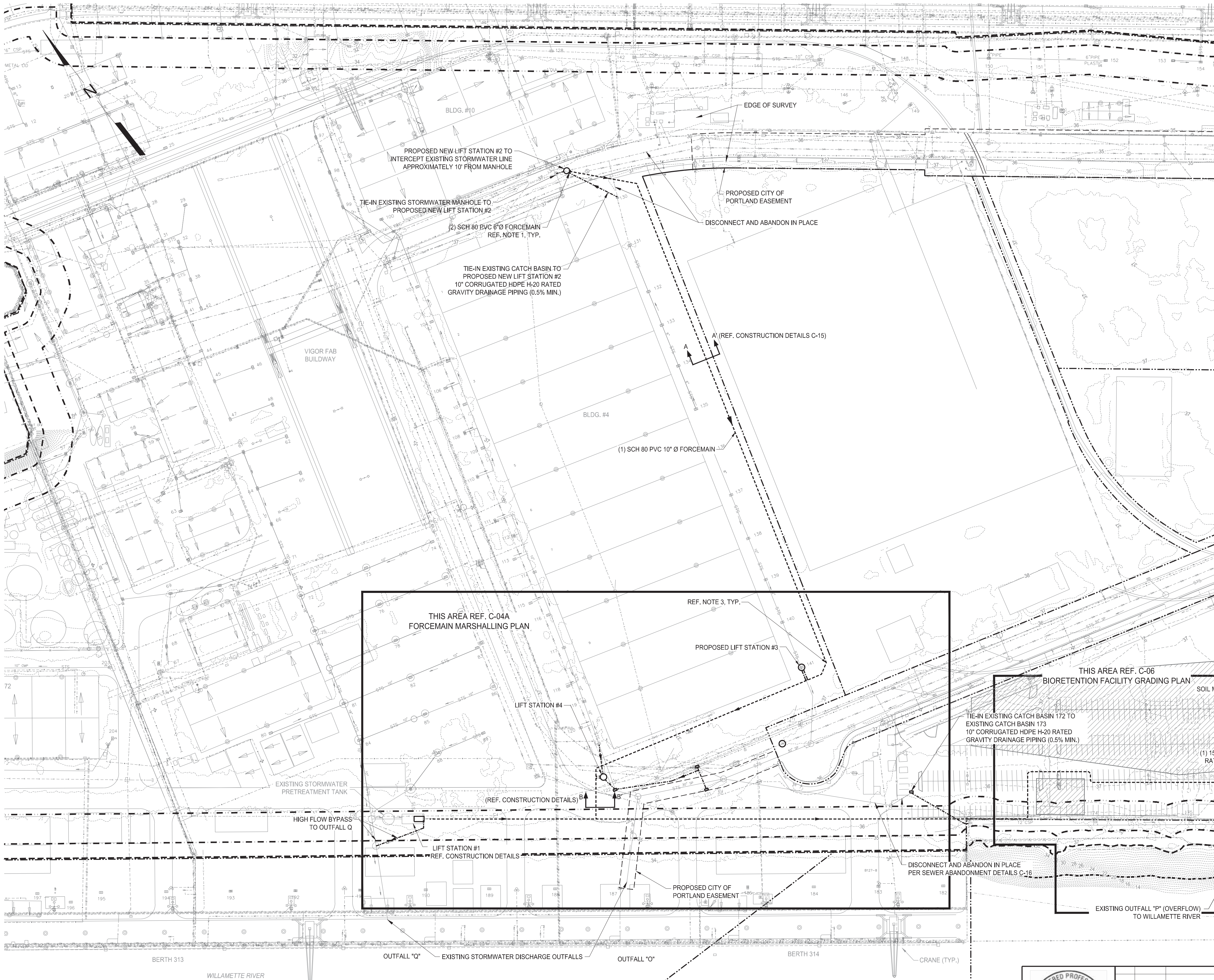

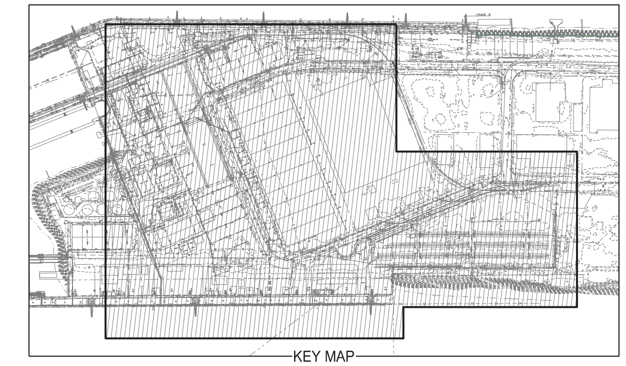

KEY MAP

NOTES:

1. LOCATIONS OF PROPOSED GRAVITY PIPES, FORCEMAINS, LIFT STATIONS, METER VAULTS, TRENCHES AND OUTFALLS MAY BE ADJUSTED TO ACCOMMODATE FIELD CONDITIONS (E.G., EXISTING UTILITIES).
2. REF. PID DRAWINGS FOR CLEANOUT LOCATIONS AND SPACING.
3. THRUST BLOCK ALL UNDERGROUND PIPE BENDS AS PER CITY OF PORTLAND PUBLIC WORKS STANDARD DRAWING #407, THRUST BLOCKING.
4. FINAL SURFACE GRADES WILL BE THE SAME AS EXISTING GRADE.
5. CONTRACTOR SHALL PROVIDE SUBMITTAL FOR OWNER'S REPRESENTATIVE APPROVAL ON CONTRACTORS SANITARY SEWER BYPASS PLAN INCLUDING REQUIRED MEANS AND METHODS.

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STORMWATER COLLECTION/CONVEYANCE PLAN

SCALE	PROJECT NUMBER	SHEET	REV.
AS SHOWN	0272376	C-04	

DATE JUNE 25, 2015 ISSUE AGENCY APPROVAL

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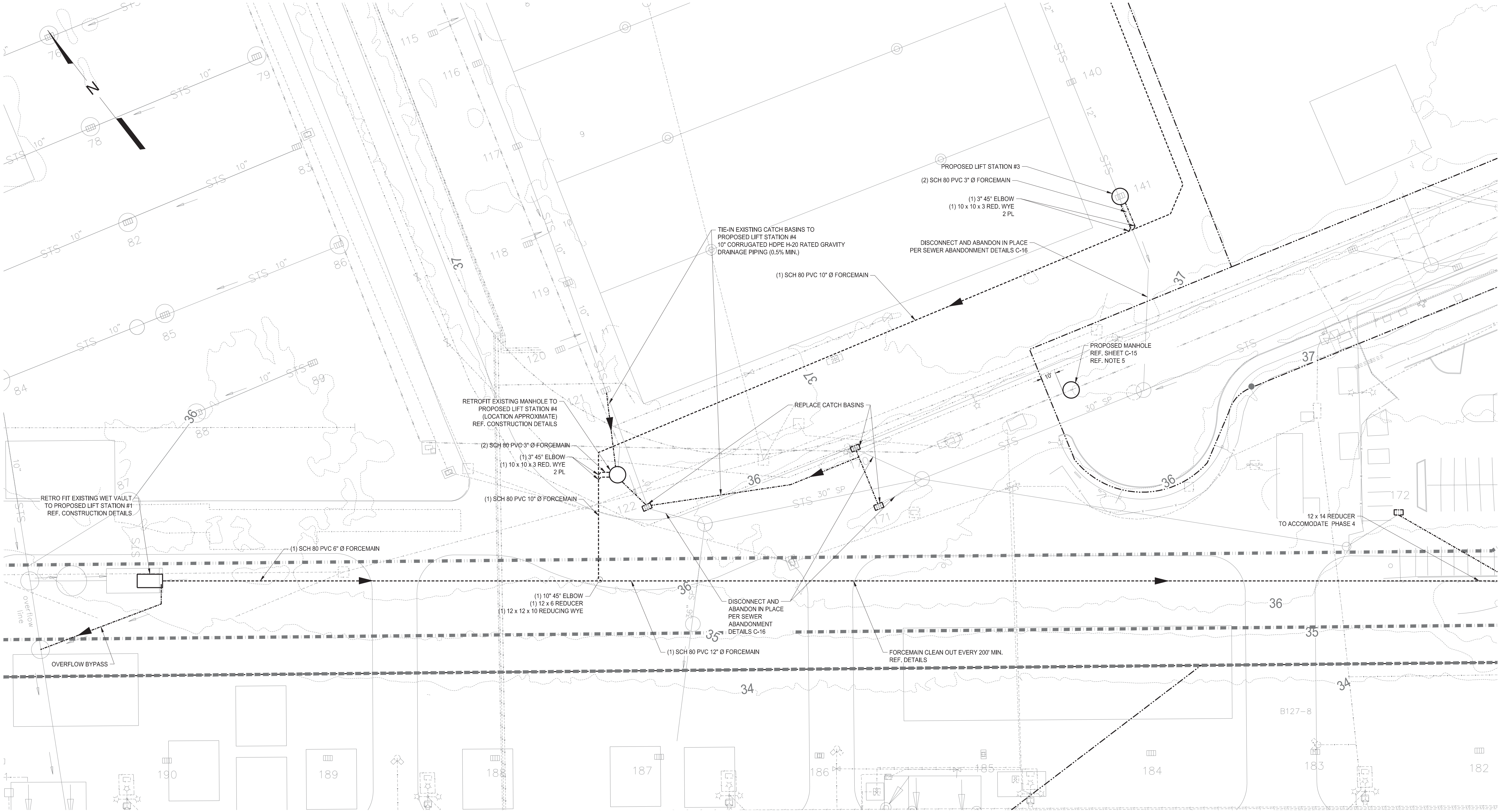

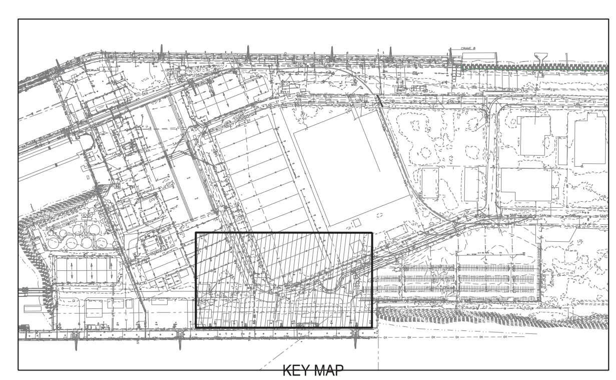

KEY MAP

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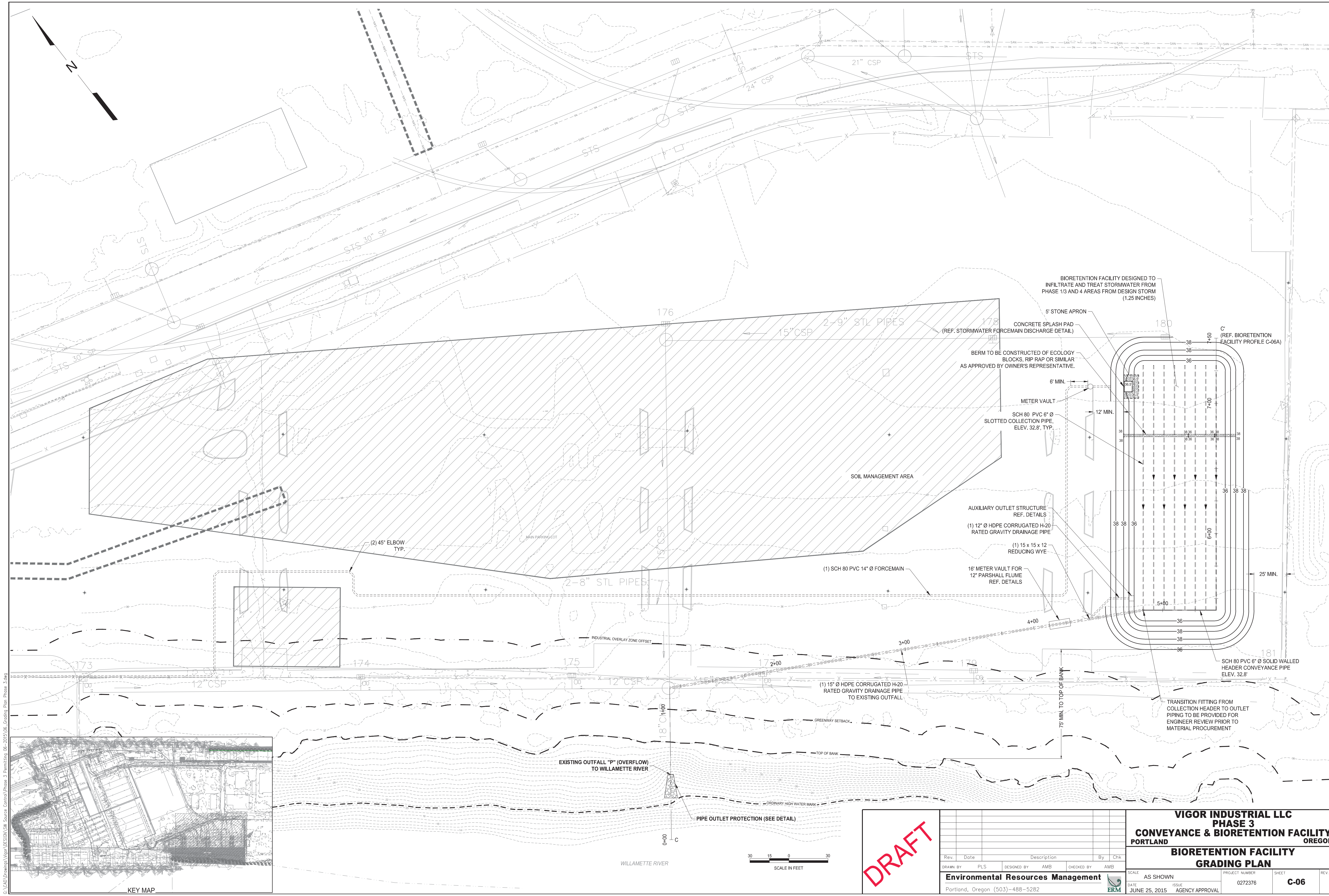
FORCEMAIN MARSHALLING PLAN

SCALE	PROJECT NUMBER	SHEET	REV.
AS SHOWN	0272376	C-04A	

DATE: JUNE 25, 2015 ISSUE: AGENCY APPROVAL



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BIORETENTION FACILITY GRADING PLAN

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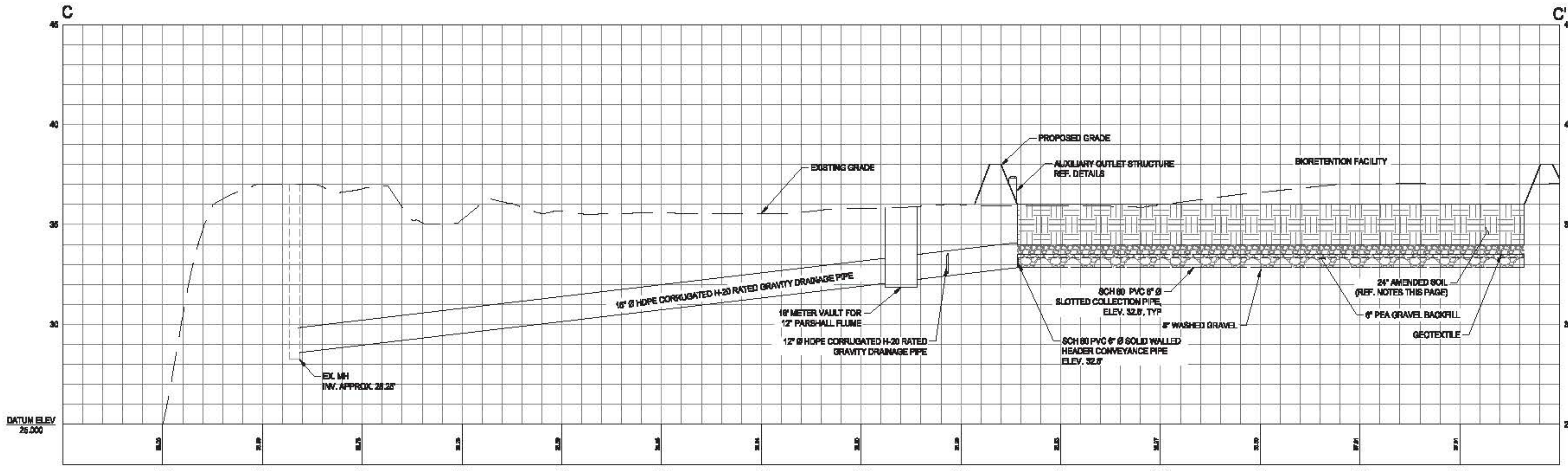
SCALE AS SHOWN | PROJECT NUMBER 0272376 | SHEET C-06 | REV.
DATE JUNE 25, 2015 | ISSUE AGENCY APPROVAL



NOTES:

1. ORGANIC MATTER CONTENT (DRY WEIGHT) - 5% OR GREATER (PER ASTM DESIGNATION D 2974).
2. PLACE CALCULATED AMOUNT OF COMPOSTED MATERIAL OR APPROVED ORGANIC MATERIAL AND MIX INTO DEPTH OF SOIL NEEDED TO ACHIEVE 24 INCHES OF SETTLED SOIL AT 5% OR GREATER ORGANIC CONTENT.
3. THE EXISTING, STOCKPILED OR IMPORTED SOIL MUST MEET THE FOLLOWING GRADATION REQUIREMENTS:

SIEVE SIZE	PECENT PASSING (BY WEIGHT)
NO. 4	100
NO. 10	95 - 100
NO. 40	40 - 60
NO. 100	10 - 25
NO. 200	5 - 10

- SAMPLING MUST MEET THE REQUIREMENTS OF AASHTO T2.
- SIEVE ANALYSIS MUST MEET THE REQUIREMENTS OF AASHTO T27 AND AASHTO T11.
- SOIL pH - 6.5 - 8.0

4. COMPOST PROPERTIES: THE ORGANIC CONTENT SHALL BE MET USING MEDIUM TYPE COMPOST ACCORDING TO SPECIAL PROVISION 3020. SPECIAL PROVISIONS CAN BE VIEWED USING THE FOLLOWING LINK:
   http://www.oregon.gov/ODOT/HWY/SPECS/special_provisions.shtml

30 15 0 30
SCALE IN FEET
10 X VERTICAL EXAGGERATION

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BIORETENTION FACILITY PROFILE

SCALE	PROJECT NUMBER	SHEET	REV.
AS SHOWN	0272376	C-06A	

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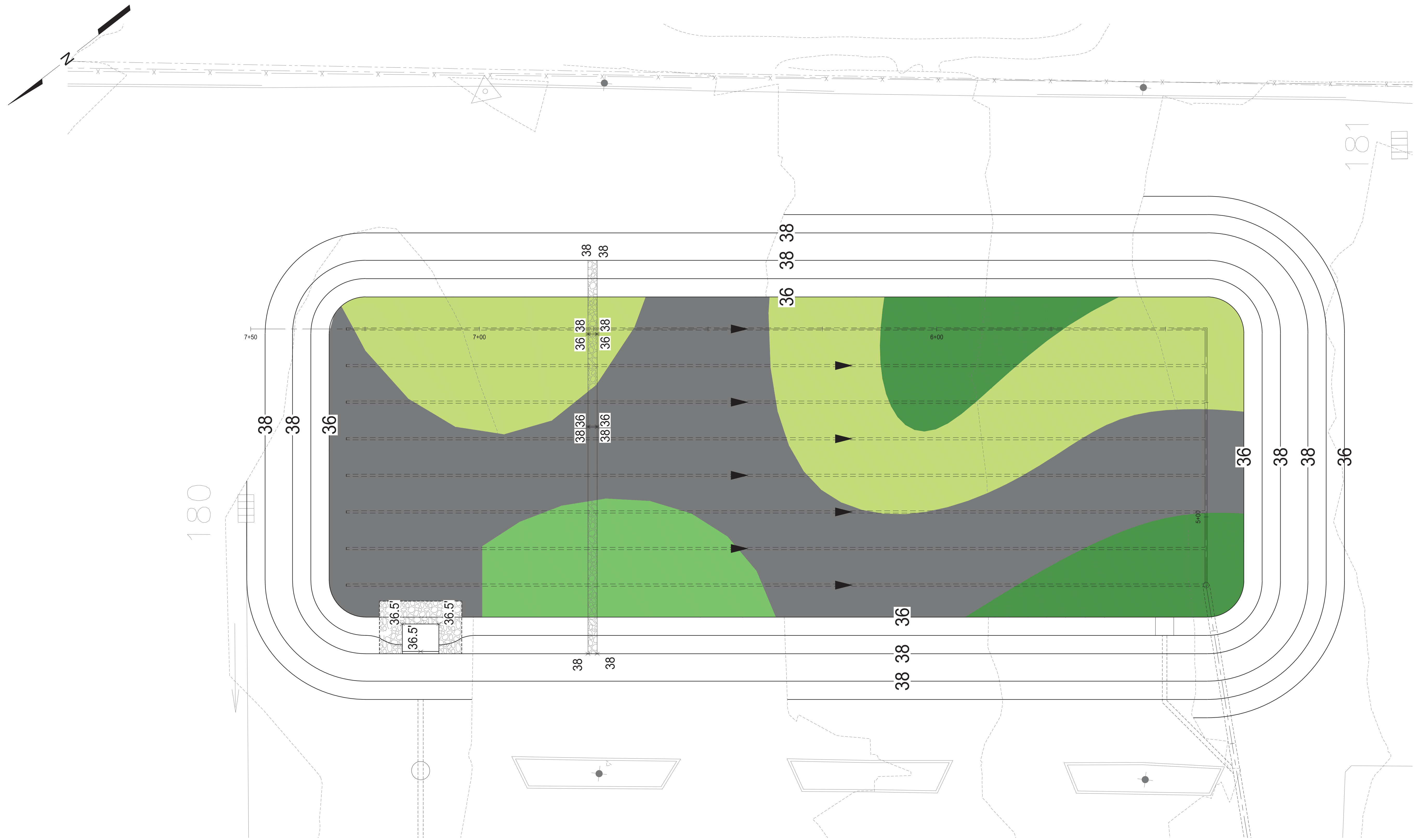

PLANTING SCHEDULE

SYMBOL	SCIENTIFIC NAME	COMMON NAME	AREA (S.F.)
	Juncus effusus	Common Rush	6,135
	Carex densa	Dense Sedge	4,239
	Juncus patens	Spreading Rush	1,331
	Carex testacea	Orange Sedge	1,776

10 5 0 10
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BIORETENTION FACILITY VEGETATION PLAN, PLANT SCHEDULE, DETAILS AND NOTES

SCALE	PROJECT NUMBER	SHEET	REV.
AS SHOWN	0272376	C-06B	

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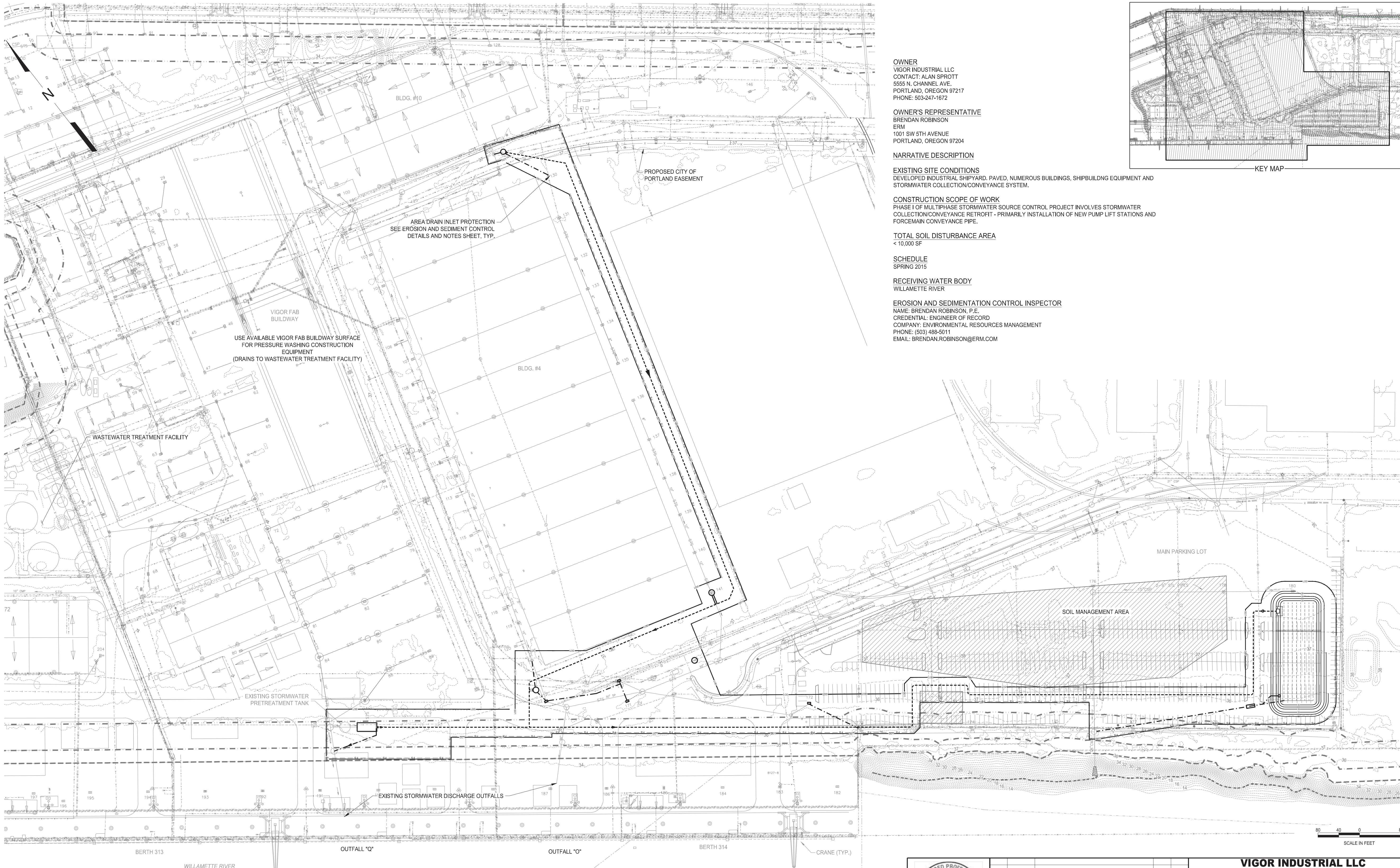

OWNER
VIGOR INDUSTRIAL LLC
CONTACT: ALAN SPROTT
5555 N. CHANNEL AVE.
PORTLAND, OREGON 97217
PHONE: 503-247-1672

OWNER'S REPRESENTATIVE
BRENDAN ROBINSON
ERM
1001 SW 5TH AVENUE
PORTLAND, OREGON 97204

NARRATIVE DESCRIPTION

EXISTING SITE CONDITIONS
DEVELOPED INDUSTRIAL SHIPYARD. PAVED, NUMEROUS BUILDINGS, SHIPBUILDNG EQUIPMENT AND STORMWATER COLLECTION/CONVEYANCE SYSTEM.

CONSTRUCTION SCOPE OF WORK
PHASE I OF MULTIPHASE STORMWATER SOURCE CONTROL PROJECT INVOLVES STORMWATER COLLECTION/CONVEYANCE RETROFIT - PRIMARILY INSTALLATION OF NEW PUMP LIFT STATIONS AND FORCEMAIN CONVEYANCE PIPE.

TOTAL SOIL DISTURBANCE AREA
< 10,000 SF

SCHEDULE
SPRING 2015

RECEIVING WATER BODY
WILLAMETTE RIVER

EROSION AND SEDIMENTATION CONTROL INSPECTOR
NAME: BRENDAN ROBINSON, P.E.
CREDENTIAL: ENGINEER OF RECORD
COMPANY: ENVIRONMENTAL RESOURCES MANAGEMENT
PHONE: (503) 488-5011
EMAIL: BRENDAN.ROBINSON@ERM.COM

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EROSION AND SEDIMENTATION CONTROL PLAN

SCALE	PROJECT NUMBER	SHEET	REV.
AS SHOWN	0272376	C-11	

DATE	ISSUE
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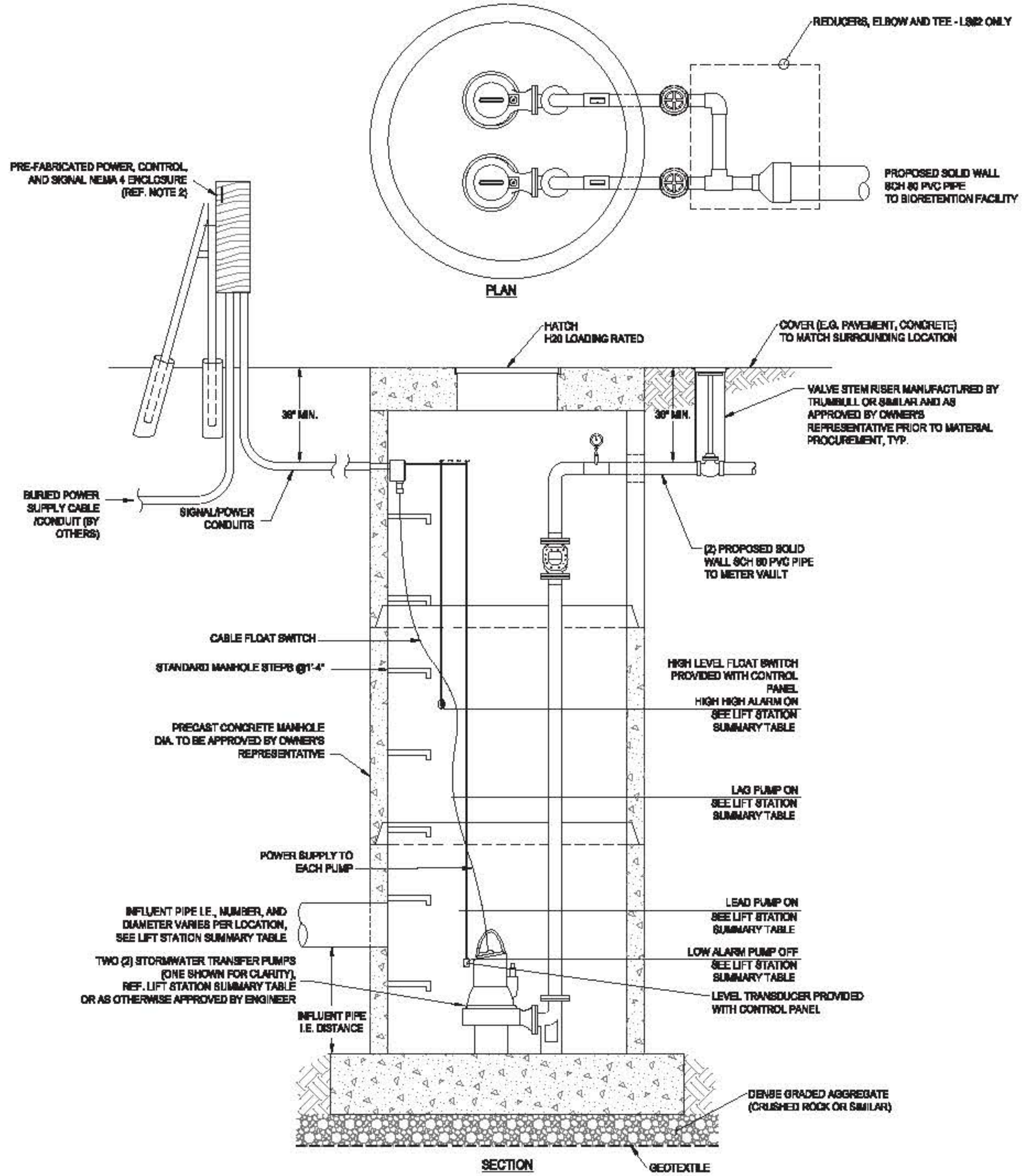
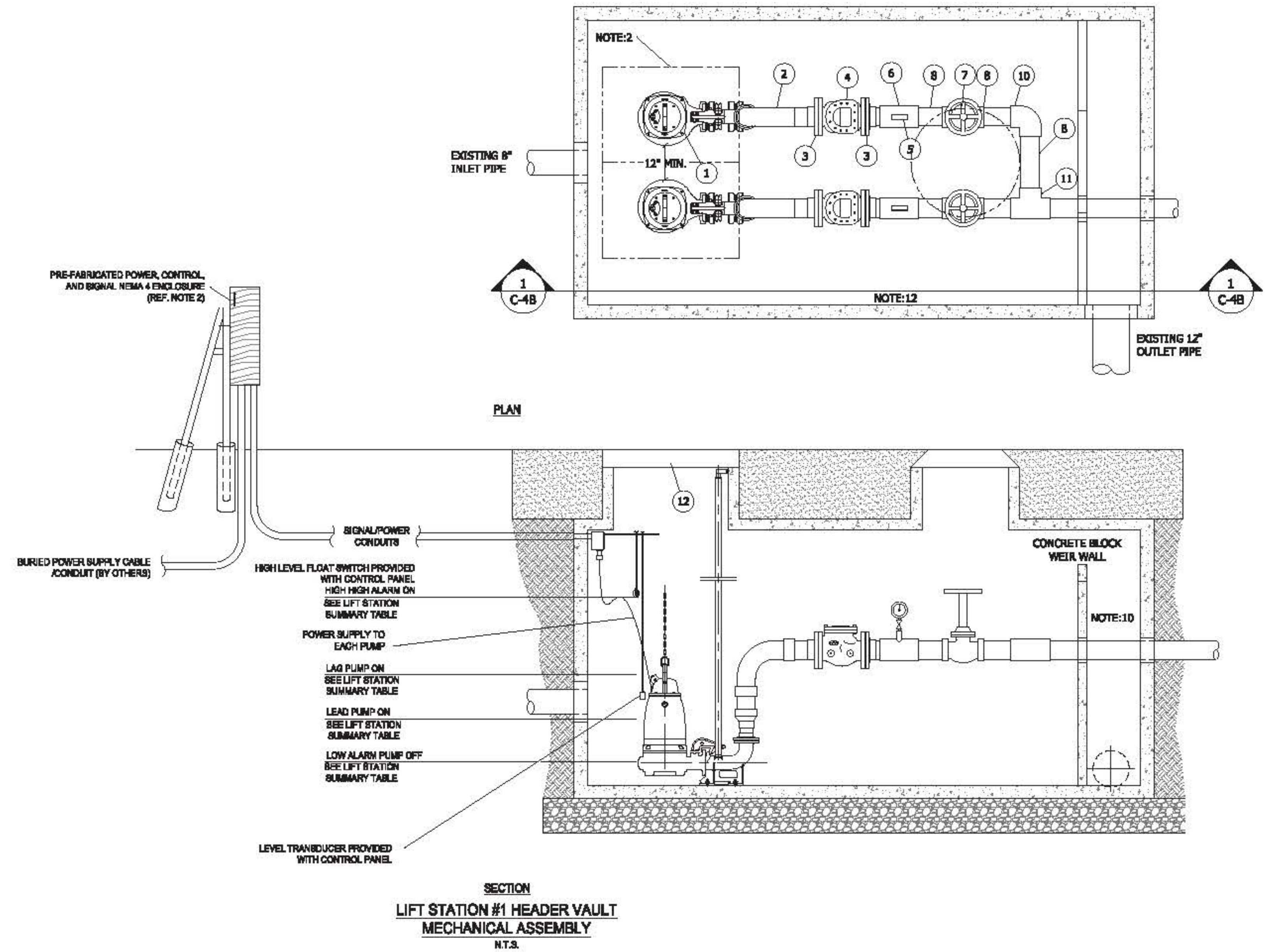


MANHOLE RETROFIT OR NEW LIFT STATION - STORMWATER COLLECTION LIFT STATION

N.T.S.



LIFT STATION #1 HEADER VAULT MECHANICAL ASSEMBLY

N.T.S.

NOTES:

1. ALL ELEVATIONS AND PIPE DIAMETERS SHOWN ARE APPROXIMATE FOR BID PURPOSES. MECHANICAL ASSEMBLY AND PARTS LIST, PIPE SUPPORTS, MANHOLE DIMENSIONS, AND PRECAST REQUIREMENTS TO BE SUBMITTED BY THE CONTRACTOR FOR APPROVAL BY THE OWNER'S REPRESENTATIVE PRIOR TO ORDERING OF THE MATERIAL/INSTALLATION.
2. PANEL PROVIDED BY PUMP VENDOR, ONE PANEL PER LIFT STATION.
3. MANHOLE PIPE PENETRATIONS TO BE GROUTED WITH NON-SHRINK GROUT AS APPROVED BY THE OWNER'S REPRESENTATIVE.
4. FLOW METER WITH TOTALIZER (NOT SHOWN) WILL CONTROL TOTAL VOLUME TO PROPOSED TREATMENT PROCESS.
5. ALARM LEVEL ELEVATIONS ARE REFERENCED ABOVE FINISHED FLOOR (AFF) OF MANHOLE.

LIFT STATION SUMMARY TABLE

LIFT STATION DETAIL	UNITS	EXISTING LIFT STATION #1 9'x15'x8.3' DEEP VAULT WITH 2'X3' MANHOLE COVER	LIFT STATION #2 NEW VAULT	LIFT STATION #3 NEW VAULT	EXISTING LIFT STATION #4 5'x5'x8.5' DEEP VAULT WITH [illegible] MANHOLE COVER
INFLUENT I.E. AND PIPE NUMBER	FT BG	(1) 7.6	(1) 15.0, (2) 15.[illegible]	(1) 15	(1) 7.2, (2) 7.2
INFLUENT PIPE I.E. DISTANCE	FT AFF	1.9	[illegible]	5	5
FINISHED FLOOR/VAULT HEIGHT	FT BG	10.2	16.6	10	12.2
PUMP INTAKE	FT BG	9.3	15.7	9.1	11.3
	FT AFF	0.9	0.9	0.9	0.9
OFF	FT AFF	1.3	1.3	1.3	1.3
LEAD PUMP ON	FT AFF	1.8	1.8	1.8	1.8
LAG PUMP ON	FT AFF	4.3	4.3	4.3	4.3
HIGH HIGH ALARM ON	FT AFF	7.8	7.8	7.8	7.8
EFFLUENT TO HEADER	ft BG	3	3	4	3
VAULT	FT AFF	7.2	13.6	7	9.2

PARTS LIST:

1. LIFT STATION PUMP, XYLEM NP 3171 HT 3
2. 6" SCHEDULE 80 90° SOCKET x SOCKET LONG SWEEP ELBOW
3. 6" 150 LB SCHEDULE 80 PVC ONE PIECE SOCKET FLANGE
4. 6" 150 LB FLANGED END SWING CHECK VALVE, TA CHEN
5. ASHCROFT TYPE 1008S SS DRY PRESSURE GAUGE W/ 100 MM DIAL RATED 0–60 PSI, OAE
6. 6"x½" SCHEDULE 80 PVC REDUCING TEE SOCKET x SOCKET x SOCKET
7. 6" 150 LB FLANGED GATE VALVE, TA CHEN
8. 6" SCHEDULE 80 PVC PIPE
9. ~~6" SCHEDULE 80 PVC 45° ELBOW SOCKET x SOCKET~~
10. 6" SCHEDULE 80 PVC 90° ELBOW SOCKET x SOCKET
11. 6" SCHEDULE 80 PVC TEE SOCKET x SOCKET x SOCKET
12. CONTRACTOR TO PROVIDE THREE SEPARATE ACCESS HATCHES OF EQUAL SIZE FOR PUMP REMOVAL AND PROVIDE SUBMITTAL FOR OWNER'S REPRESENTATIVE APPROVAL.

NOTES:

1. PRECAST STRUCTURES WILL CONFORM TO SECTION 106.07 OF THE ODOT SPECIFICATIONS. THE MANUFACTURER WILL HAVE THE OPTION OF SELECTING THE COMBINATION OF PRECAST UNITS TO COMPLETE A STRUCTURE.
2. THE EXISTING STRUCTURE TOP FOR LIFT STATION 1 SHALL BE MODIFIED IN THE FIELD TO ENABLE PUMP REMOVAL AND MAINTENANCE OF NEW INFRASTRUCTURE. THE MODIFICATION SHALL BE DESIGNED BY A STRUCTURAL ENGINEER AND CONTRACTOR SHALL PROVIDE SIGNED/SEALED PLANS FOR THE STRUCTURAL RETROFIT IN A SUBMITTAL TO BE APPROVED BY THE ENGINEER.
3. IN THE EVENT THE INVERT OF THE INLET PIPE IS HIGHER THAN THE BOTTOM OF THE STRUCTURE, THE INVERT OF THE STRUCTURE SHALL BE SHAPED WITH CEMENT MORTAR TO PREVENT STANDING OR PONDING OF WATER IN THE STRUCTURE.
4. ALL PRECAST STRUCTURES AND FOOTING TO BE CONSTRUCTED WITH 4,000 PSI MINIMUM CONCRETE.
5. ALL SPACER UNITS, FLAT AND TAPER, ARE TO BE IN ACCORDANCE WITH THE REQUIREMENTS OF AASHTO M199.
6. SPACER UNITS TO BE DOWELED OR MORTARED TO TAPER UNIT OR FLAT SLAB TOP.
7. REINFORCEMENT TO BE IN ACCORDANCE WITH ODOT REQUIREMENTS.
8. MANHOLE PIPE PENETRATIONS TO BE GROUTED WITH NON-SHRINK GROUT AS APPROVED BY THE OWNER'S REPRESENTATIVE.
9. ALL CONNECTIONS SHALL BE ANSI B16.5 CLASS 150 FLANGES UNLESS OTHERWISE NOTED. FLANGE TYPE SHALL BE SOCKET WELD.
10. MODIFY EXISTING WEIR DIMENSIONS AS PER DRAWING.
11. ALL PIPE PENETRATIONS THROUGH VAULT SHALL INCLUDE A LINK SEAL AROUND PIPE.
12. PIPE SUPPORT REQUIREMENTS, VAULT DIMENSIONS, VAULT HATCH ACCESS, AND VAULT PRECAST REQUIREMENTS TO BE APPROVED BY OWNERS REPRESENTATIVE.

REGISTERED PROFESSIONAL ENGINEER 78496PE OREGON DECEMBER 31, 2002 BRENDAN ANDREW ROBINSON

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PHASE 3
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PORTLAND OREGON

CONSTRUCTION DETAILS
LIFT STATION 1,2,3,4

SCALE: AS SHOWN | PROJECT NUMBER: 0272378 | SHEET: C-14 | REV.:
DATE: JUNE 25, 2015 | ISSUE: AGENCY APPROVAL

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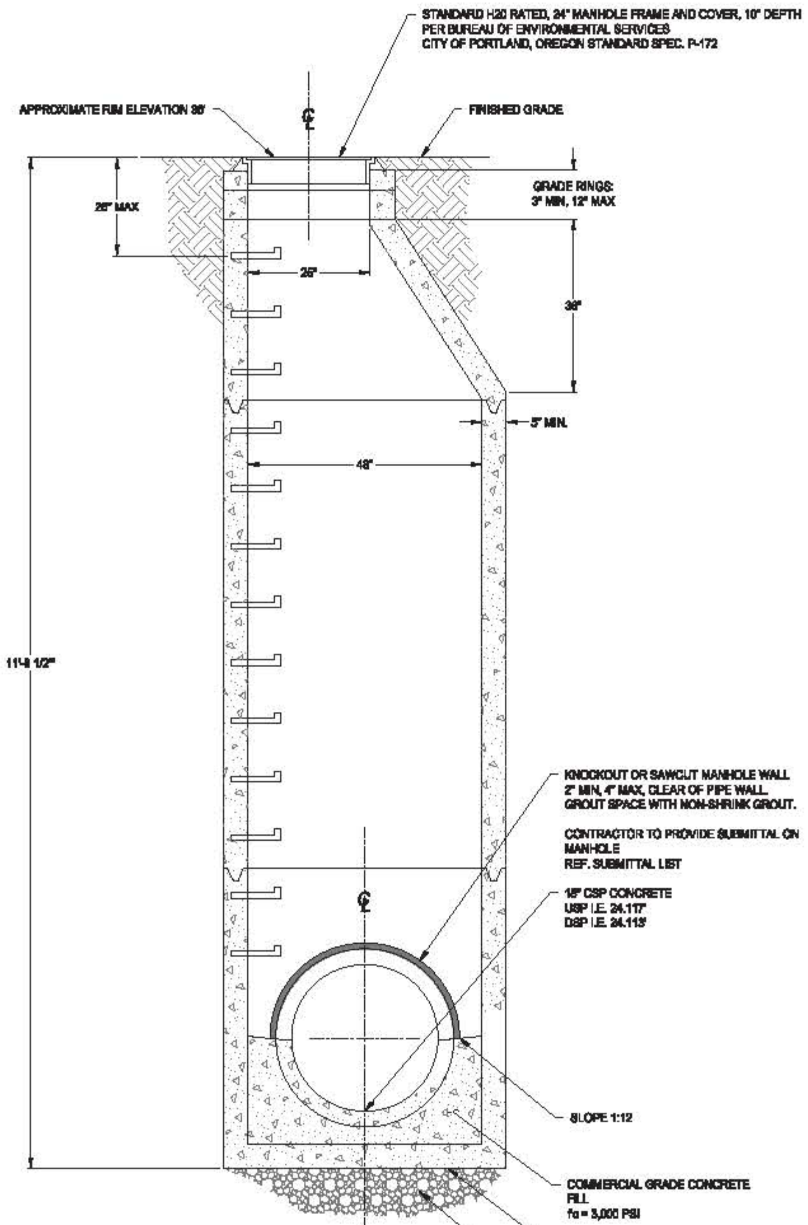
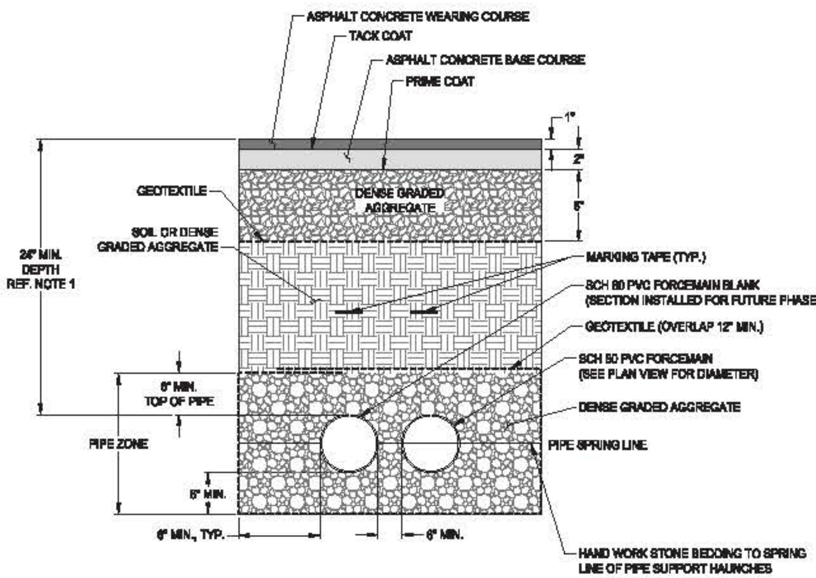


NOTES:
1. WHEN INCOMING AND OUTGOING SEWERS HAVE THE SAME DIAMETER, THE CHANNEL WIDTH SHALL BE THE SAME AS THE SEWER INSIDE DIAMETER
2. FOR SEWERS LESS THAN 12-INCHES THE MINIMUM RADIUS OF THE CHANNEL CENTERLINE SHALL BE 1/2 THE DIAMETER.
3. FOR SEWERS GREATER THAN OR EQUAL TO 12-INCHES THE MINIMUM RADIUS OF THE OUTER CHANNEL WALL SHALL BE 1/2 THE DIAMETER.
4. INCOMING AND OUTGOING SEWER IE CALCULATED BY SEWER PROFILE.
5. MANHOLE TYPE IS PRECAST
6. MANHOLE DIAMETER IS 48 INCHES
7. MANHOLE NOM DIA FRAME AND COVER IS 24 INCHES

MANHOLE DETAIL

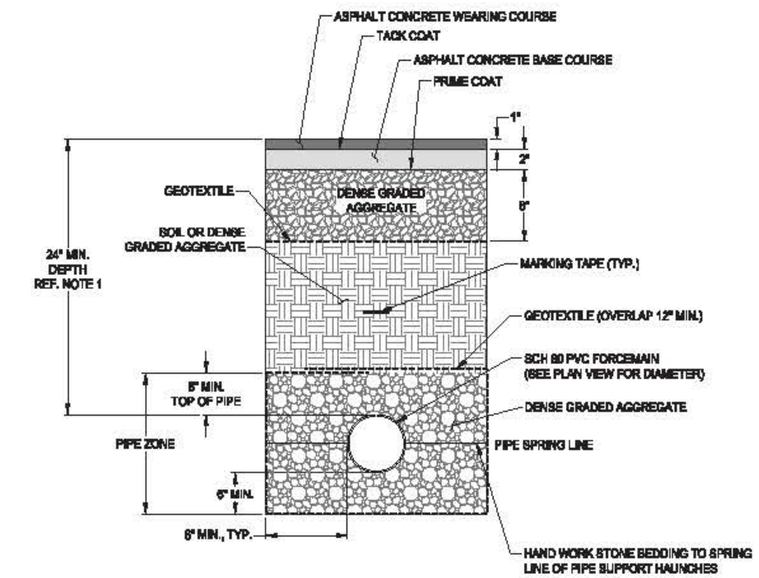
PER BUREAU OF ENVIRONMENTAL SERVICES
CITY OF PORTLAND, OREGON STANDARD SPEC. P-150
N.T.S.



NOTES:
1. FORCEMAIN / UTILITY CROSSING TO BE FIELD DETERMINED AS APPROVED BY OWNER'S REPRESENTATIVE AND SHALL MAINTAIN A 6" NOM. SEPARATION BETWEEN PIPES.
2. FORCEMAIN TO BE INSTALLED IN A MANNER TO REDUCE THE NUMBER OF HIGH POINTS. WHERE FORCEMAIN CROSSES AN EXISTING UTILITY, IF POSSIBLE THE FORCEMAIN SHOULD BE INSTALLED IN A MANNER (E.G., BELOW THE UTILITY) THAT DOES NOT CREATE A HIGH POINT. COMBINATION AIR VALVES TO BE INSTALLED AT FORCEMAIN HIGH POINTS.

TRENCH DETAIL B - B'

N.T.S.



NOTES:
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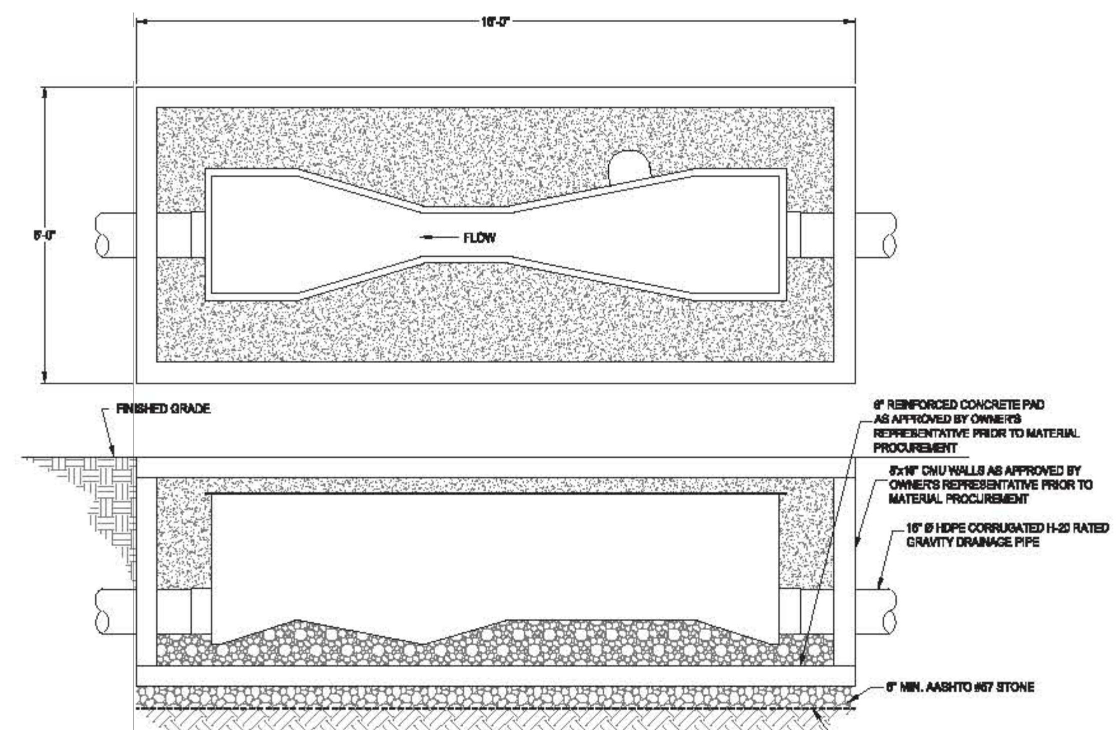
2. FORCEMAIN TO BE INSTALLED IN A MANNER TO REDUCE THE NUMBER OF HIGH POINTS. WHERE FORCEMAIN CROSSES AN EXISTING UTILITY, IF POSSIBLE THE FORCEMAIN SHOULD BE INSTALLED IN A MANNER (E.G., BELOW THE UTILITY) THAT DOES NOT CREATE A HIGH POINT. COMBINATION AIR VALVES TO BE INSTALLED AT FORCEMAIN HIGH POINTS.

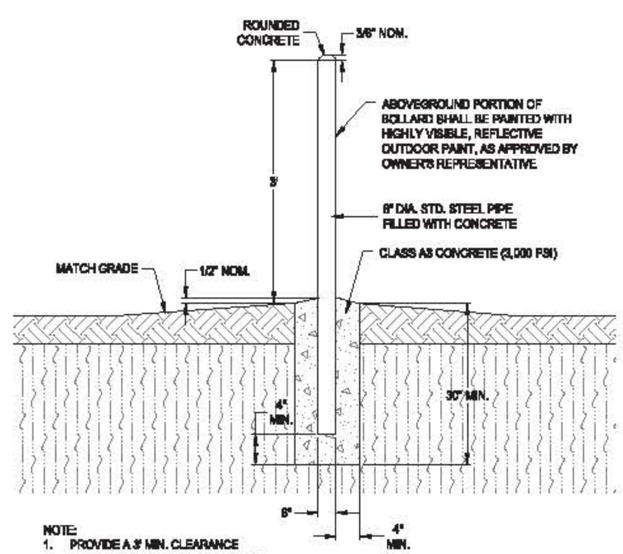
TRENCH DETAIL A - A'

N.T.S.



16' METER VAULT FOR 12" PARSHALL FLUME

N.T.S.



NOTE:
1. PROVIDE A 3' MIN. CLEARANCE BETWEEN MANHOLE AND BOLLARD.

BOLLARD

N.T.S.

GENERAL NOTE:
1. MATERIALS OF CONSTRUCTION (i.e. STONE, AGGREGATE, GEOTEXTILE, PIPING, ETC.) TO BE APPROVED BY THE ENGINEER PRIOR TO INSTALLATION.

REGISTERED PROFESSIONAL ENGINEER 78496PE OREGON DECEMBER 31, 2007 BRENDAN ANDREW ROBINSON
EXP. 12/31/2016

Rev.	Date	Description	By	Chk

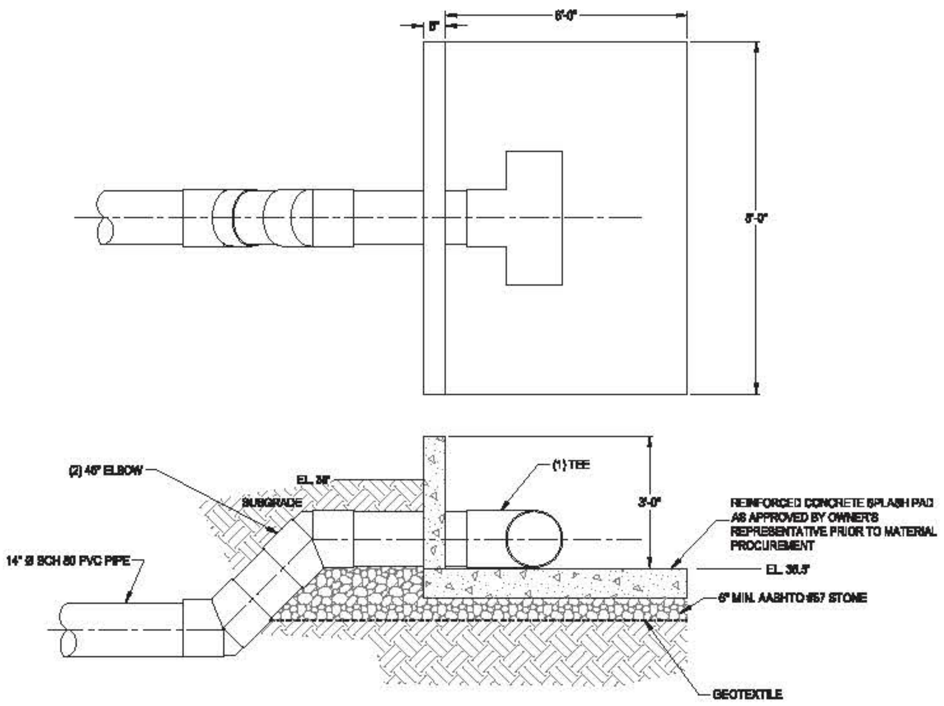
DRAWN BY PLS | DESIGNED BY AMB | CHECKED BY AMB

Environmental Resources Management
Portland, Oregon (503)-488-5282

VIGOR INDUSTRIAL LLC
PHASE 3
CONVEYANCE & BIORETENTION FACILITY
PORTLAND **OREGON**

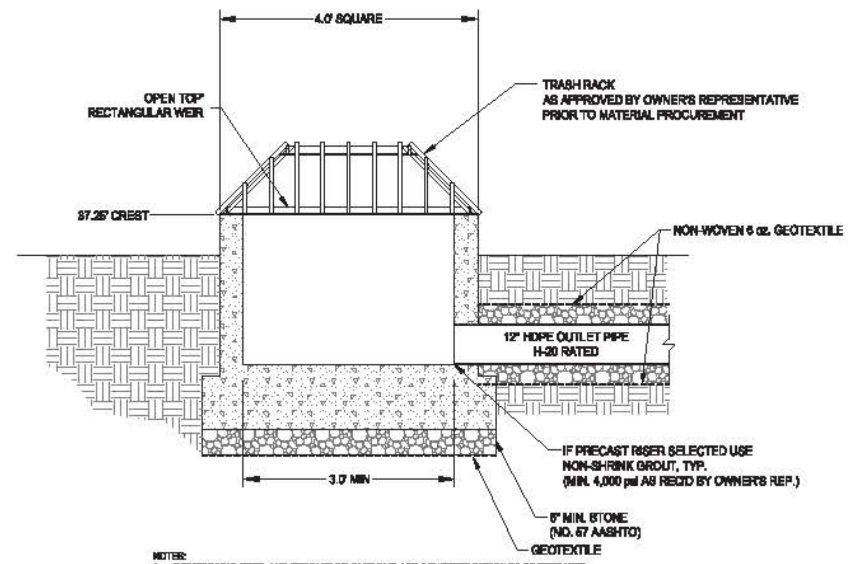
CONSTRUCTION DETAILS

SCALE	PROJECT NUMBER	SHEET	REV.
AS SHOWN	0272376	C-15	
DATE JUNE 25, 2015 / ISSUE AGENCY APPROVAL			



STORMWATER FORCEMAIN DISCHARGE DETAIL

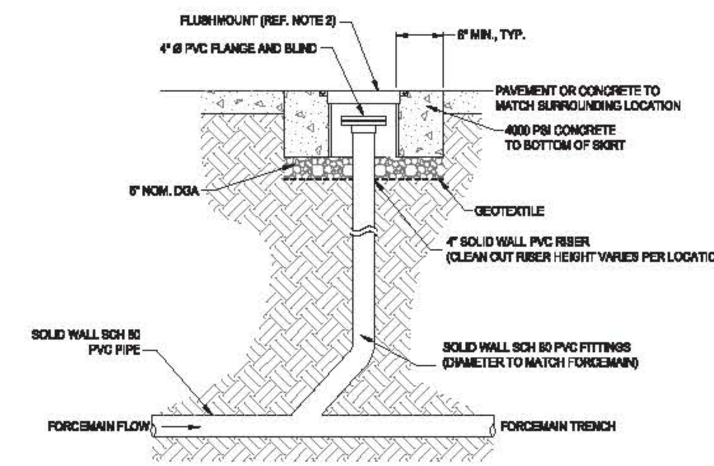
N.T.S.



NOTES:
1. REINFORCING STEEL AND PRECAST OR CAST-IN-PLACE CONCRETE DESIGN TO BE PREPARED BY CONTRACTOR'S PROFESSIONAL DESIGN ENGINEER LICENSED IN THE STATE OF OREGON FOR REVIEW AND APPROVED BY THE OWNER'S REPRESENTATIVE.
2. THIS ITEM MAY BE PRECAST OR CAST-IN-PLACE AS APPROVED BY THE OWNER'S REPRESENTATIVE.

AUXILIARY OUTLET STRUCTURE FOR BIORETENTION FACILITY

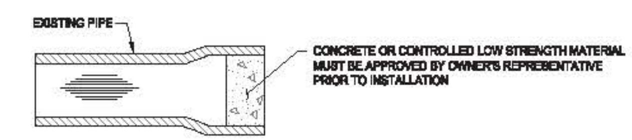
N.T.S.



NOTES:
1. CLEAN OUT RISER HEIGHT VARIES PER LOCATION.
2. FLUSHMOUNT SHALL BE H20-RATED STEEL, CIRCULAR OR SQUARE. DIAMETER OR X/Y DIMENSIONS SHALL BE SUFFICIENT TO ALLOW BLIND FLANGE BOLTS TO BE REMOVED. SKIRT LENGTH SHALL BE 18".
3. FORCEMAIN CLEAN OUTS REQUIRED EVERY 200'.

FORCEMAIN CLEAN OUT DETAIL

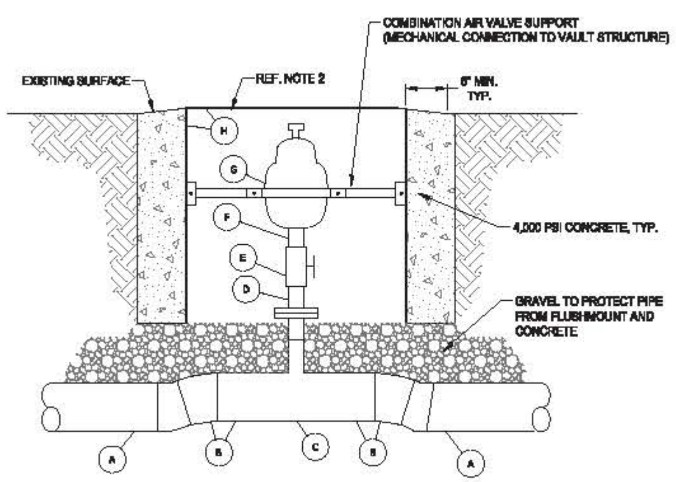
N.T.S.



NOTES:
1. PRIOR TO ABANDONING ANY STORMWATER OR SANITARY SEWER LATERAL, THE CONTRACTOR SHALL ACQUIRE ANY ASSOCIATED PERMITS AND FOLLOW ALL PIPE ABANDONING GUIDELINES SET FORTH BY: PORT OF PORTLAND, CITY OF PORTLAND, AND BY THE STATE OF OREGON.
2. THE CONTRACTOR SHALL DETERMINE WHETHER THE PIPE AND ASSOCIATED APPURTENANCE AND STRUCTURES SHOULD BE ABANDONED IN PLACE, PHYSICALLY REMOVED, OR FILLED WITH CONTROLLED LOW STRENGTH MATERIAL (CLSM) OR OTHER APPROVED MATERIAL.
3. SEWERS 12-IN AND LESS IN DIAMETER:
   A. ABANDON SEWERS IN PLACE UNLESS IT CAN BE DETERMINED THAT THE RISK OF STRUCTURAL FAILURE IS HIGH OR REMOVAL IS NECESSARY TO AVOID CONFLICT WITH A NEW SEWER.
   B. BEFORE EARMARKING A SEWER FOR ABANDONMENT, CLEAN AND REMOTELY INSPECT THE SEWER.
   C. DETERMINE ITS STRUCTURAL CONDITION AND WETHER ANY ACTIVE SERVICE LATERALS CONNECT TO THE SEWER.
   D. IF IT IS DETERMINED NOT TO POSE A FAILURE RISK, THE PIPE MAY BE ABANDONED IN-PLACE. PERMANENT PLUGS OF IMPERMEABLE MATERIAL (E.G. CONCRETE OR CLSM) SHALL BE PLACED AT THE UPSTREAM AND DOWNSTREAM ENDS OF THE ABANDONED SEWER.
   E. IF A SEWER PRESENTS UNDO RISK OF FAILURE, REMOVE OR FILL THE SEWER FOR ITS ENTIRE LENGTH WITH CLSM OR SAND.
4. SEWERS GREATER THAN 12-IN DIAMETER:
   A. ABANDON SEWER IN-PLACE OR REMOVE THE SEWER IF ITS LOCATION CONFLICTS WITH A NEW FACILITY.
   B. ACCOMPLISH ABANDON IN-PLACE ABANDONMENT BY FILLING SEWER WITH CLSM OR SAND.

SEWER ABANDONMENT

N.T.S.



COMBINATION AIR VALVE NOTES:
1. COMBINATION AIR VALVE TO BE INSTALLED AT EACH HIGH POINT IN THE FORCEMAIN CONVEYANCE PIPING.
2. FLUSHMOUNT TO BE INSTALLED APPROXIMATELY 1" ABOVE SURROUNDING GRADE, WITH CONCRETE SLOPING TO GRADE, TO REDUCE STORMWATER RUN-ON.
3. COMBINATION AIR VALVE SHALL BE INSTALLED LEVEL WITH AN ACCURACY OF +/- ONE DEGREE FOR CORRECT OPERATION.
4. CONTRACTOR TO SKETCH SUPPORT FOR COMBINATION AIR VALVE AND RISER FOR OWNER'S REPRESENTATIVE TO APPROVE.

COMBINATION AIR VALVE PARTS LIST:
A. SOLID WALL SCH 80 PVC PIPE (SEE PLAN VIEW FOR DIAMETER).
B. SCH 80 PVC FITTINGS IF NECESSARY TO ENSURE HIGH POINT IN FORCEMAIN.
C. PIPE DIAMETER X 2" SCH 80 PVC REDUCING TEE.
D. 2" SCH 80 PVC PIPE, AS NEEDED TO CONNECT BALL VALVE OR TO ATTAIN RISER HEIGHT.
E. 2" SCH. 80 PVC BALL VALVE. THE VALVE SHALL BE INSTALLED AT A HEIGHT THAT WILL ENABLE ACCESS TO THE HANDLE.
F. 2" SCH. 80 PVC PIPE/FITTINGS, AS NEEDED TO CONNECT BALL VALVE TO COMBINATION AIR VALVE.
G. 2" INLET, 1" OUTLET CRISPIN COMBINATION AIR VALVE, MODEL UX20-FT, OR APPROVED EQUIVALENT.
H. 24" X 24" SQUARE STEEL FLUSHMOUNT WITH HINGED LID WITH INSET PADLOCK CAPABILITY. H20 RATED. SKIRT LENGTH AS NEEDED TO EXTEND BELOW THE BOTTOM OF THE BALL VALVE TO ALLOW FUTURE ACCESS TO BALL VALVE. MODEL A0717-724VW MANUFACTURED BY EMCO WHEATON RETAIL, OR APPROVED EQUIVALENT.

COMBINATION AIR VALVE

N.T.S.

REGISTERED PROFESSIONAL ENGINEER 78496PE OREGON BRENDAN ANDREW ROBINSON

EXP. 12/31/2016

Rev.	Date	Description	By	Chk
DRAWN BY PLS	DESIGNED BY AMS		CHECKED BY	AMB

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CONSTRUCTION DETAILS

SCALE	PROJECT NUMBER	SHEET	REV.
AS SHOWN	0272376	C-16	
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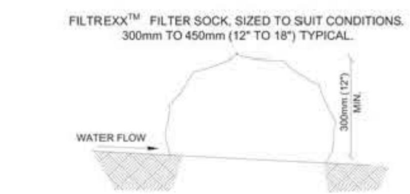
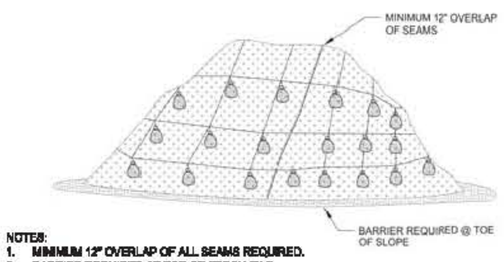
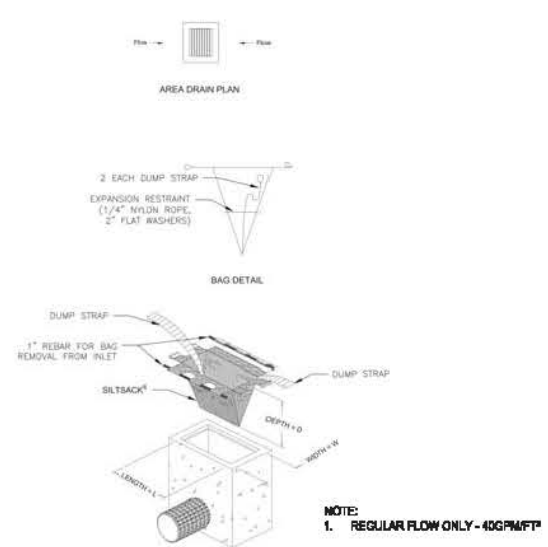


COMPOST SOCK
N.T.S.



NOTES:
1. MINIMUM 12" OVERLAP OF ALL SEAMS REQUIRED.
2. BARRIER REQUIRED AT TOE OF STOCK PILE.
3. COVERING MAINTAINED TIGHTLY IN PLACE USING SANDBAGS OR TIRES ON ROPES WITH A MAXIMUM 10' GRID SPACING IN ALL DIRECTIONS.

PLASTIC SHEETING
N.T.S.



NOTE:
1. REGULAR FLOW ONLY - 40GPM/FT²

AREA DRAIN INLET PROTECTION
N.T.S.

BMP AND ESCP IMPLEMENTATION

	Year:	2015					
BMPs	Month #:	04	05				
Pipe Slope Drains							
Energy Dissipaters							
Temporary Diversion Dikes							
Check Dams							
Temporary Seeding and Planting							
Permanent Seeding and Planting							
Mycorrhizae/ Biofertilizers							
Mulches (Specify Type)							
Construction Entrance							
Compost Blankets							
Compost Socks							
Compost Berm							
Soil Tackifiers							
Sodding Vegetative Buffer Strips							
Plastic Sheeting		X	X				
Sediment Fencing							
Erosion Control Blankets & Mats (Specify type)							
Earth Dikes (Stabilized)							
Drainage Swales							
Rock Outlet Protection							
Sediment Trap							
Straw Wattles (Loose compaction rice straw)		X	X				
Storm Drain Inlet Protection		X	X				
Temporary or Permanent Sedimentation Basins							
Unpaved roads graveled or other BMP on the road							
Dewatering (treatment location, schematic & sampling plan required)							
Paving Operations Controls		X	X				
Concrete Truck Washout (Eco-pans)		X	X				
Street Sweeping		X	X				

SOIL EROSION AND SEDIMENT CONTROL NOTES:

1. HOLD A PRE-CONSTRUCTION MEETING OF PROJECT CONSTRUCTION PERSONNEL THAT INCLUDES THE INSPECTOR TO DISCUSS EROSION AND SEDIMENT CONTROL MEASURES AND CONSTRUCTION LIMITS. (SCHEDULE A.8.C.I.(3))
2. ALL INSPECTIONS MUST BE MADE IN ACCORDANCE WITH DEQ 1200-C PERMIT REQUIREMENTS.
3. INSPECTION LOGS MUST BE KEPT IN ACCORDANCE WITH DEQ'S 1200-C PERMIT REQUIREMENTS.
4. RETAIN A COPY OF THE ESCP AND ALL REVISIONS ON SITE AND MAKE IT AVAILABLE ON REQUEST TO DEQ, AGENT, OR THE LOCAL MUNICIPALITY. DURING INACTIVE PERIODS OF GREATER THAN SEVEN (7) CONSECUTIVE CALENDAR DAYS, RETAIN THE ESCP AT THE CONSTRUCTION SITE OR AT ANOTHER LOCATION. (SCHEDULE B.2.A)
5. ALL PERMIT REGISTRANTS MUST IMPLEMENT THE ESCP. FAILURE TO IMPLEMENT ANY OF THE CONTROL MEASURES OR PRACTICES DESCRIBED IN THE ESCP IS A VIOLATION OF THE PERMIT. (SCHEDULE A 8.A)
6. THE ESCP MEASURES SHOWN ON THIS PLAN ARE MINIMUM REQUIREMENTS FOR ANTICIPATED SITE CONDITIONS. DURING THE CONSTRUCTION PERIOD, UPGRADE THESE MEASURES AS NEEDED TO COMPLY WITH ALL APPLICABLE LOCAL, STATE, AND FEDERAL EROSION AND SEDIMENT CONTROL REGULATIONS. (SCHEDULE A.8.C.II.(1)(C))
7. SUBMISSION OF ALL ESCP REVISIONS IS NOT REQUIRED. SUBMITTAL OF THE ESCP REVISIONS IS ONLY UNDER SPECIFIC CONDITIONS. SUBMIT ALL NECESSARY REVISION TO DEQ OR AGENT. (SCHEDULE A.12.C.II)
8. PHASE CLEARING AND GRADING TO THE MAXIMUM EXTENT PRACTICAL TO PREVENT EXPOSED INACTIVE AREAS FROM BECOMING A SOURCE OF EROSION. (SCHEDULE A 8.C.II.(1)(D))
9. IDENTIFY, MARK, AND PROTECT (BY FENCING OFF OR OTHER MEANS) CRITICAL RIPARIAN AREAS AND VEGETATION INCLUDING IMPORTANT TREES AND ASSOCIATED ROOTING ZONES, AND VEGETATION AREAS TO BE PRESERVED. IDENTIFY VEGETATIVE BUFFER ZONES BETWEEN THE SITE AND SENSITIVE AREAS (E.G., WETLANDS), AND OTHER AREAS TO BE PRESERVED, ESPECIALLY IN PERIMETER AREAS. (SCHEDULE A.8.C.I.(1) & (2))
10. PRESERVE EXISTING VEGETATION WHEN PRACTICAL AND RE-VEGETATE OPEN AREAS. RE-VEGETATE OPEN AREAS WHEN PRACTICABLE BEFORE AND AFTER GRADING OR CONSTRUCTION. IDENTIFY THE TYPE OF VEGETATIVE SEED MIX USED. (SCHEDULE A.7.B.III(1) AND A.7.B.III(3))
11. EROSION AND SEDIMENT CONTROL MEASURES INCLUDING PERIMETER SEDIMENT CONTROL MUST BE IN PLACE BEFORE VEGETATION IS DISTURBED AND MUST REMAIN IN PLACE AND BE MAINTAINED, REPAIRED, AND PROMPTLY IMPLEMENTED FOLLOWING PROCEDURES ESTABLISHED FOR THE DURATION OF CONSTRUCTION, INCLUDING PROTECTION FOR ACTIVE STORM DRAIN INLETS AND CATCH BASINS AND APPROPRIATE NON-STORMWATER POLLUTION CONTROLS. (SCHEDULE A.7.D.I AND A.8.C)
12. ESTABLISH CONCRETE TRUCK AND OTHER CONCRETE EQUIPMENT WASHOUT AREAS BEFORE BEGINNING CONCRETE WORK. (SCHEDULE A.8.C.I.(6))
13. APPLY TEMPORARY AND/OR PERMANENT SOIL STABILIZATION MEASURES IMMEDIATELY ON ALL DISTURBED AREAS AS GRADING PROGRESSES AND FOR ALL ROADWAYS INCLUDING GRAVEL ROADWAYS. (SCHEDULE A.8.C.II.(2))
14. ESTABLISH MATERIAL AND WASTE STORAGE AREAS, AND OTHER NON-STORMWATER CONTROLS. (SCHEDULE A.8.C.I.(7))
15. PREVENT TRACKING OF SEDIMENT ONTO PUBLIC OR PRIVATE ROADS USING BMPS SUCH AS: GRAVELED (OR PAVED) EXITS AND PARKING AREAS, GRAVEL ALL UNPAVED ROADS LOCATED ONSITE, OR USE AN EXIT TIRE WASH. THESE BMPS MUST BE IN PLACE PRIOR TO LAND-DISTURBING ACTIVITIES. (SCHEDULE A.7.D.II.(1) AND A.8.C.I(4))
16. WHEN TRUCKING SATURATED SOILS FROM THE SITE, EITHER USE WATER-TIGHT TRUCKS OR DRAIN LOADS ON SITE. (SCHEDULE A.7.D.II.(3))
17. USE BMPS TO PREVENT OR MINIMIZE STORMWATER EXPOSURE TO POLLUTANTS FROM SPILLS; VEHICLE AND EQUIPMENT FUELING, MAINTENANCE, AND STORAGE; OTHER CLEANING AND MAINTENANCE ACTIVITIES; AND WASTE HANDLING ACTIVITIES. THESE POLLUTANTS INCLUDE FUEL, HYDRAULIC FLUID, AND OTHER OILS FROM VEHICLES AND MACHINERY, AS WELL AS DEBRIS, LEFTOVER PAINTS, SOLVENTS, AND GLUES FROM CONSTRUCTION OPERATIONS. (SCHEDULE A.7.E.I.(2))
18. IMPLEMENT THE FOLLOWING BMPS WHEN APPLICABLE: WRITTEN SPILL PREVENTION AND RESPONSE PROCEDURES, EMPLOYEE TRAINING ON SPILL PREVENTION AND PROPER DISPOSAL PROCEDURES, SPILL KITS IN ALL VEHICLES, REGULAR MAINTENANCE SCHEDULE FOR VEHICLES AND MACHINERY, MATERIAL DELIVERY AND STORAGE CONTROLS, TRAINING AND SIGNAGE, AND COVERED STORAGE AREAS FOR WASTE AND SUPPLIES. (SCH A 7.E.III.)
19. USE WATER, SOIL-BINDING AGENT OR OTHER DUST CONTROL TECHNIQUE AS NEEDED TO AVOID WIND-BLOWN SOIL. (SCHEDULE A 7.B.II)
20. THE APPLICATION RATE OF FERTILIZERS USED TO REESTABLISH VEGETATION MUST FOLLOW MANUFACTURER'S RECOMMENDATIONS TO MINIMIZE NUTRIENT RELEASES TO SURFACE WATERS. EXERCISE CAUTION WHEN USING TIME-RELEASE FERTILIZERS WITHIN ANY WATERWAY RIPARIAN ZONE. (SCHEDULE A.9.B.III)
21. IF A STORMWATER TREATMENT SYSTEM (FOR EXAMPLE, ELECTRO-COAGULATION, FLOCCULATION, FILTRATION, ETC.) FOR SEDIMENT OR OTHER POLLUTANT REMOVAL IS EMPLOYED, SUBMIT AN OPERATION AND MAINTENANCE PLAN (INCLUDING SYSTEM SCHEMATIC, LOCATION OF SYSTEM, LOCATION OF INLET, LOCATION OF DISCHARGE, DISCHARGE DISPERSION DEVICE DESIGN, AND A SAMPLING PLAN AND FREQUENCY) BEFORE OPERATING THE TREATMENT SYSTEM. OBTAIN PLAN APPROVAL BEFORE OPERATING THE TREATMENT SYSTEM. OPERATE AND MAINTAIN THE TREATMENT SYSTEM ACCORDING TO MANUFACTURER'S SPECIFICATIONS. (SCHEDULE A.9.D)
22. TEMPORARILY STABILIZE SOILS AT THE END OF THE SHIFT BEFORE HOLIDAYS AND WEEKENDS, IF NEEDED. THE REGISTRANT IS RESPONSIBLE FOR ENSURING THAT SOILS ARE STABLE DURING RAIN EVENTS AT ALL TIMES OF THE YEAR. (SCHEDULE A 7.B)
23. AT THE END OF EACH WORKDAY SOIL STOCKPILES MUST BE STABILIZED OR COVERED, OR OTHER BMPS MUST BE IMPLEMENTED TO PREVENT DISCHARGES TO SURFACE WATERS OR CONVEYANCE SYSTEMS LEADING TO SURFACE WATERS. (SCHEDULE A 7.E.II.(2))
24. CONSTRUCTION ACTIVITIES MUST AVOID OR MINIMIZE EXCAVATION AND CREATION OF BARE GROUND DURING WET WEATHER. (SCHEDULE A.7.A.I)
25. SEDIMENT FENCE: REMOVE TRAPPED SEDIMENT BEFORE IT REACHES ONE THIRD OF THE ABOVE GROUND FENCE HEIGHT AND BEFORE FENCE REMOVAL. (SCHEDULE A.9.C.I)
26. OTHER SEDIMENT BARRIERS (SUCH AS BIOBAGS): REMOVE SEDIMENT BEFORE IT REACHES TWO INCHES DEPTH ABOVE GROUND HEIGHT. AND BEFORE BMP REMOVAL. (SCHEDULE A.9.C.II)
27. CATCH BASINS: CLEAN BEFORE RETENTION CAPACITY HAS BEEN REDUCED BY FIFTY PERCENT. SEDIMENT BASINS AND SEDIMENT TRAPS: REMOVE TRAPPED SEDIMENTS BEFORE DESIGN CAPACITY HAS BEEN REDUCED BY FIFTY PERCENT AND AT COMPLETION OF PROJECT. (SCHEDULE A.9.C.III & IV)
28. WITHIN 24 HOURS, SIGNIFICANT SEDIMENT THAT HAS LEFT THE CONSTRUCTION SITE, MUST BE REMEDIATED. INVESTIGATE THE CAUSE OF THE SEDIMENT RELEASE AND IMPLEMENT STEPS TO PREVENT A RECURRENCE OF THE DISCHARGE WITHIN THE SAME 24 HOURS. ANY IN-STREAM CLEAN UP OF SEDIMENT SHALL BE PERFORMED ACCORDING TO THE OREGON DIVISION OF STATE LANDS REQUIRED TIMEFRAME. (SCHEDULE A.9.B.I)
29. THE INTENTIONAL WASHING OF SEDIMENT INTO STORM SEWERS OR DRAINAGE WAYS MUST NOT OCCUR. VACUUMING OR DRY SWEEPING AND MATERIAL PICKUP MUST BE USED TO CLEANUP RELEASED SEDIMENTS. (SCHEDULE A.9.B.II)
30. THE ENTIRE SITE MUST BE TEMPORARILY STABILIZED USING VEGETATION OR A HEAVY MULCH LAYER, TEMPORARY SEEDING, OR OTHER METHOD SHOULD ALL CONSTRUCTION ACTIVITIES CEASE FOR 30 DAYS OR MORE. (SCHEDULE A.7.F.I)
31. PROVIDE TEMPORARY STABILIZATION FOR THAT PORTION OF THE SITE WHERE CONSTRUCTION ACTIVITIES CEASE FOR 14 DAYS OR MORE WITH A COVERING OF BLOWN STRAW AND A TACKIFIER, LOOSE STRAW, OR AN ADEQUATE COVERING OF COMPOST MULCH UNTIL WORK RESUMES ON THAT PORTION OF THE SITE. (SCHEDULE A.7.F.II)
32. PROVIDE PERMANENT EROSION CONTROL MEASURES ON ALL EXPOSED AREAS. DO NOT REMOVE TEMPORARY SEDIMENT CONTROL PRACTICES UNTIL PERMANENT VEGETATION OR OTHER COVER OF EXPOSED AREAS IS ESTABLISHED. HOWEVER, DO REMOVE ALL TEMPORARY EROSION CONTROL MEASURES AS EXPOSED AREAS BECOME STABILIZED, UNLESS DOING SO CONFLICTS WITH LOCAL REQUIREMENTS. PROPERLY DISPOSE OF CONSTRUCTION MATERIALS AND WASTE, INCLUDING SEDIMENT RETAINED BY TEMPORARY BMPS. (SCHEDULE A.7.B.II(2) AND A.8.C.II)

EROSION AND SEDIMENTATION CONTROL INSPECTION FREQUENCIES	
SITE CONDITION	MINIMUM FREQUENCY
ACTIVE PERIOD	DAILY WHEN STORMWATER RUNOFF, INCLUDING RUNOFF FROM SNOWMELT, IS OCCURRING. AT LEAST ONCE EVERY TWO WEEKS, REGARDLESS OF WHETHER OR NOT RUNOFF IS OCCURRING.
PRIOR TO THE SITE BECOMING INACTIVE OR IN ANTICIPATION OF SITE INACCESSIBILITY.	ONCE TO ENSURE THAT EROSION AND SEDIMENT CONTROL MEASURES ARE IN WORKING ORDER. ANY NECESSARY MAINTENANCE AND REPAIR MUST BE MADE PRIOR TO LEAVING THE SITE.
INACTIVE PERIODS GREATER THAN FOURTEEN (14) CALENDAR DAYS.	ONCE EVERY TWO (2) WEEKS.
PERIODS DURING WHICH THE SITE IS INACCESSIBLE DUE TO INCLEMENT WEATHER.	IF PRACTICAL, INSPECTIONS MUST OCCUR DAILY AT A RELEVANT AND ACCESSIBLE DISCHARGE POINT OR DOWNSTREAM LOCATION.

CONTAMINATED SOIL MANAGEMENT NOTES:

1. CONTRACTOR SHALL NOTIFY OWNER'S REPRESENTATIVE IF CONTAMINATED SOIL IS ENCOUNTERED DURING EXCAVATION OR TRENCHING WORK BASED ON VISUAL OR OLFACTORY EVIDENCE OF CONTAMINATION.
2. OWNER'S REPRESENTATIVE WILL COORDINATE AND IMPLEMENT SAMPLING AND CHARACTERIZATION OF SUSPECTED CONTAMINATED SOIL TO DETERMINE APPROPRIATE END USE (BACKFILL OR OFF-SITE DISPOSAL). SAMPLING FREQUENCY SHALL BE AT A RATE OF 1 SAMPLE PER 50 CUBIC YARDS OF MATERIAL. ALL TESTING SHALL BE PREFORMED AT A STATE-CERTIFIED ANALYTICAL LABORATORY AND USING EPA OR STATE APPROVED ANALYTICAL METHODS.
3. CONTRACTOR SHALL TEMPORARILY STOCKPILE SUSPECTED CONTAMINATED SOIL SEPARATELY FROM NON-CONTAMINATED SOIL AT PAVED LOCATION IDENTIFIED BY OWNER'S REPRESENTATIVE.
4. CONTRACTOR SHALL PLACE CONTAMINATED SOILS ON PLASTIC SHEETING (6 mil MINIMUM THICKNESS).
5. CONTRACTOR SHALL COVER SUSPECTED CONTAMINATED SOIL STOCKPILE WITH PLASTIC SHEETING (REF. DETAIL, THIS PAGE).
6. CONTRACTOR SHALL CONSTRUCT BARRIERS TO PREVENT STORMWATER RUN-ON IN THE STOCKPILE AREA.
7. CONTRACTOR SHALL EMPLOY STREET SWEEPING AND OTHER BMPS AS NEEDED TO PREVENT TRACKING SOIL AWAY FROM WORK AREAS (REF. BMP AND ESCP IMPLEMENTATION SCHEDULE, THIS PAGE).
8. AT OWNER'S REPRESENTATIVE'S DIRECTION, CONTRACTOR SHALL COORDINATE TRANSPORTATION TO OWNER'S REPRESENTATIVE APPROVED DISPOSAL FACILITY.

REGISTERED PROFESSIONAL ENGINEER 78496PE OREGON DECEMBER 31, 2007 BRENDAN ANDREW ROBINSON EXP. 12/31/2016

Rev.	Date	Description	By	Chk

DRAWN BY PLS DESIGNED BY AMB CHECKED BY AMB

Environmental Resources Management
Portland, Oregon (503)-488-5282

VIGOR INDUSTRIAL LLC
PHASE 3
CONVEYANCE & BIORETENTION FACILITY
PORTLAND OREGON

EROSION AND SEDIMENTATION CONTROL DETAILS AND NOTES

SCALE AS SHOWN
DATE JUNE 25, 2015
ISSUE AGENCY APPROVAL
PROJECT NUMBER 0272378
SHEET C-18
REV.

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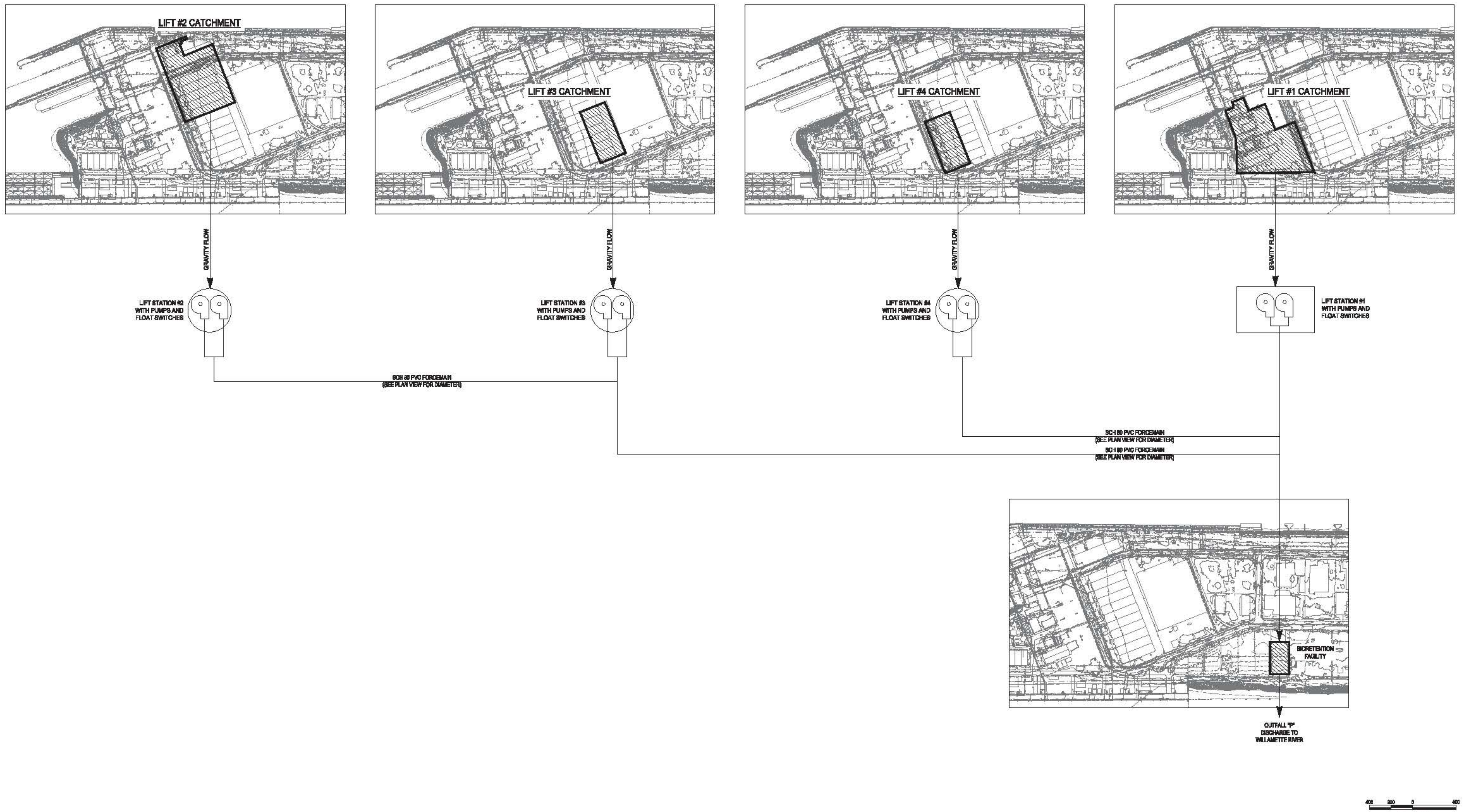


REGISTERED PROFESSIONAL ENGINEER
78496PE
OREGON
DECEMBER 31, 2007
BRENDAN ANDREW ROBINSON
EXP. 12/31/2016

Rev.	Date	Description	By	Chk

DRAWN BY PLS | DESIGNED BY AMB | CHECKED BY AMB

Environmental Resources Management
Portland, Oregon (503)-488-5282

VIGOR INDUSTRIAL LLC
PHASE 3
CONVEYANCE & BIORETENTION FACILITY
PORTLAND **OREGON**

PROCESS FLOW DIAGRAM
BIORETENTION FACILITY IMPLEMENTATION - PHASE 3

SCALE	PROJECT NUMBER	SHEET	REV.
AS SHOWN	0272376	C-20	

DATE JUNE 25, 2015 | ISSUE AGENCY APPROVAL

P & ID VALVE AND PIPING SYMBOLS

- GATE
- GLOBE
- BALL
- BUTTERFLY
- DIAPHRAGM
- VALVE WITH TAPPED DRAIN
- SWING CHECK VALVE
- BALL CHECK VALVE
- SPRING CHECK VALVE
- THREE WAY BALL VALVE
- FOUR WAY BALL VALVE
- NEEDLE
- PINCH
- KNIFE
- PLUG
- PRESSURE SAFETY OR RELIEF VALVE (PSV)
- FUSIBLE LINK VALVE
- SPRING OPERATED SELF CLOSING HAND VALVE
- HOSE BIB
- UNION OR RESTRICTION ORIFICE
- CONCENTRIC REDUCER
- ECCENTRIC REDUCER
- AIR/GAS QUICK CONNECT
- ONE WAY HOSE COUPLING
- TWO WAY HOSE COUPLING
- SP/02 SPECIALTY ITEM
- AR AIR RELEASE

- THREADED CONNECTION
- FLANGED CONNECTION
- WELDED CONNECTION
- SANITARY CONNECTION
- COMPRESSION CONNECTION
- BLIND FLANGE
- FLEXIBLE CONNECTION
- HOSE CONNECTION
- PIPE CAP
- DRAIN LEG
- DRAIN
- EXPANSION JOINT
- EDUCTOR /EJECTOR
- STRAINER (Y TYPE)
- STRAINER (SINGLE BASKET)
- STRAINER (DOUBLE BASKET)
- FILTER OR SPECIAL STRAINER
- STRAINER (CONE TYPE)
- T INDUSTRIAL STEAM TRAP; T1 SIP TRAP; T2 PURE STEAM DRIP LEG TRAP; MT AIR MOISTURE TRAP
- SIGHT LEVEL GLASS
- FIGURE 8 SPECTACLE BLIND
- FLUSH BOTTOM VALVE
- KW HEATER, ELECTRIC
- M MOTOR
- FLAME ARRESTOR
- RAIN HOOD
- PULSATION DAMPENER

- ROTA-METER
- SIGHT FLOW INDICATOR
- DIAPHRAM ACTUATOR
- ROTORY ACTUATOR
- S SOLENOID
- PISTON ACTUATOR
- PRESSURE REGULATING
- BACKFLOW PREVENTOR
- ULTRASONIC FLOW METER
- OPEN CHANNEL FLUME

- RUPTURE DISC
- VACUUM SAFETY RUPTURE DISC
- LOAD CELL
- TEMPERATURE SENSOR W/O THERMOWELL
- TEMPERATURE SENSOR WITH THERMOWELL
- ORIFICE PLATE
- SANITARY DIAPHRAGM SEAL
- CHEMICAL SEAL
- FI FLOW INDICATOR
- F AIR FILTER
- P STEAM PURIFIER
- FW WATER FILTER
- BACKFLOW PREVENTER
- HU- MIXING HOSE UNIT STEAM & COLD WATER
- EWES- EYE WASH & SAFETY SHOWER
- VB- VACUUM BREAKER
- JACKETED VALVE
- CSO CAR SEAL OPEN
- CSC CAR SEAL CLOSED
- TANK LIGHT
- L AIR LUBRICATOR
- F CARTRIDGE FILTER

CONTROL VALVE OPERATORS AND VALVES

- SELF-CONTAINED BACK PRESSURE REGULATING VALVE
- NO INDICATION — MANUAL
- CH — CHAIN
- MODULATING
- DISCRETE (OPEN/CLOSE)
- POSITION SWITCH
- SELF-CONTAINED TEMPERATURE REGULATOR
- SELF CONTAINED PRESSURE REDUCING AND / OR REGULATING VALVE
- S 2-WAY SOLENOID VALVE
- S 3-WAY SOLENOID VALVE
- S 4 WAY SOLENOID VALVE (SHOWN DEENERGIZED)
- FC — FAIL POSITION: FC FAIL CLOSED; FO FAIL OPEN; FP FAIL IN POSITION
- S F A — SOLENOID VALVE (FAIL POSITION SHOWN)
- M MOTOR OPERATED VALVE
- MODULATING WITH POSITIONER

SANITARY PROCESS VALVES

- Y BODY
- 2-WAY SHUTOFF
- 3-WAY
- 3-WAY DIVERTER
- 4-WAY VALVE
- 45° 90° TANK OUTLET VALVES

INSTRUMENT LINE SYMBOLS

- DIRECT CONNECTION OR MECHANICAL LINK TO INSTRUMENT
- I INTERLOCK
- INSTRUMENT AIR SUPPLY
- SIGNAL LINE (ELECTRICAL)
- SIGNAL LINE (PNEUMATIC)
- CAPILLARY LINE TO INSTRUMENT
- HYDRAULIC SIGNAL LINE
- ULTRA SONIC
- COMPUTER SOFTWARE LINK
- LOCALLY MOUNTED INSTRUMENT
- FRONT OF MAIN PANEL INSTRUMENT
- FRONT OF LOCAL PANEL INSTRUMENT
- REAR OF MAIN PANEL INSTRUMENT
- REAR OF LOCAL PANEL INSTRUMENT
- SOFTWARE FUNCTION
- INSTRUMENT FUNCTION ON SHARED DEVICE
- COMBINATION INSTRUMENTS
- INDICATOR LIGHT
- PORTABLE INSTRUMENT OR INSTRUMENT SHOWN ON ANOTHER DRAWING
- AI ANALOG INPUT SIGNAL TO COMPUTER SYSTEM
- AO ANALOG OUTPUT SIGNAL FROM COMPUTER SYSTEM
- DI DISCRETE INPUT SIGNAL TO COMPUTER SYSTEM
- DO DISCRETE OUTPUT SIGNAL FROM COMPUTER SYSTEM

PROCESS LINE IDENTIFICATION

- MAIN FLOW
- SECONDARY FLOW & RECYCLE
- DIRECTION OF FLOW
- ALTERNATE FLOW
- HEAT TRACED LINE (E ------ ELECTRICAL; S ------ STEAM)
- INSULATED LINE
- OUT OF FUNCTION/DETAILED ON ANOTHER DRAWING
- REMOVABLE
- PACKAGE BOUNDARY
- EXISTING
- POC POINT OF CONNECTION
- INDICATES LINE INTERRUPTED IN P & I DWG FOR CLARITY
- PIPE, MATERIAL CONTINUATION FLAG BETWEEN DRAWINGS

INSTRUMENT IDENTIFICATION

PROCUREMENT (#)

SEE NOTES ON P&IDs FOR EXPLAINATION OF #s 1 ,2, & 3

LIC 0001A

SPECIAL FUNCTION OR ANALYZER TYPE

XXXYYY ← LOCATION CODE

LIC-0001 A INSTRUMENT NUMBER
- SUFFIX TO PREVENT DUPLICATION (IF NECESSARY)
- INSTRUMENT LOOP NUMBER
- MEASURED VARIABLE AND INSTRUMENT FUNCTION

XXXYYY LOCATION CODE
- LOCATION NUMBER
- LOCATION TYPE IDENTIFIER
  - LP# LOCAL PANEL
  - MP# MAIN PANEL
  - OIT OPERATOR INTERFACE TERMINAL
  - MCC MOTOR CONTROL CENTER
  - ANN ANNUNCIATOR
  - XJR MULTIPOINT SCANNING RECORDER

IDENTIFICATION LETTERS FOR INSTRUMENTS

	FIRST LETTER		SUCCEEDING-LETTERS	
	MEASURED OR INITIATING VARIABLE	MODIFIER	FUNCTION	MODIFIER
A	ANALYSIS		ALARM	
B	BURNER , COMBUSTION			
C			CONTROL, CLOSED	
D		DIFFERENTIAL	DEVICE	
E	VOLTAGE		ELEMENT	
F	FLOW RATE	RATIO (FRACTION)		
G			GLASS , VIEWING DEVICE	
H	HAND			HIGH
I	CURRENT (ELECTRICAL)		INDICATE	
J	POWER	SCAN		
K	TIME , TIME SCHEDULE	TIME RATE OF CHANGE	CONTROL STATION	
L	LEVEL		LIGHT	LOW
M		MOMENTARY		MIDDLE , INTERMEDIATE
N				
O			ORIFICE , RESTRICTION, OPEN	
P	PRESSURE , VACUUM		POINT (TEST) CONNECTION	
Q	QUANTITY	INTEGRATE , TOTALIZE		
R			RECORD	
S	SELECTION, SAMPLE, SPEED, SOLENOID, FREQUENCY	SAFETY	SWITCH	
T	TEMPERATURE		TRANSMIT	
U	MULTIVARIABLE		MULTIFUNCTION	MULTIFUNCTION
V	VIBRATION , MECHANICAL ANALYSIS, VISCOSITY		VALVE , DAMPER , LOUVER	
W	WEIGHT , FORCE		WELL	
X	USER SPECIFIED (INDICATION)	X AXIS		
Y	EVENT , STATE OR PRESENCE	Y AXIS	RELAY , COMPUTE CONVERT	
Z	POSITION , DIMENSION	Z AXIS	DRIVER , ACTUATOR , UNCLASSIFIED FINAL CONTROL ELEMENT	

DESCRIPTION OF ANALYZER TYPES

- V = VISCOSITY
- D = DENSITY
- LEL = LOWER EXPLOSIVE LIMIT
- M = MOISTURE
- COND = CONDENSATE
- T = TURBIDITY
- ORP = OXIDATION REDUCTION POTENTIAL
- DO = DISSOLVED OXYGEN
- PH = pH
- OD = OPTICAL DENSITY (UV)

SPECIAL FUNCTIONS

- Σ ADD
- AVG AVERAGE
- ± BIAS
- ÷ DIVIDE
- f(x) CHARACTERIZE
- < LOW SELECTOR
- > HIGH SELECTOR
- A/D ANALOG/DIGITAL
- x^n RAISE TO POWER
- D DERIVATIVE OR RATE
- 1/D INVERSE DERIVATIVE
- √ SQUARE ROOT
- 1:3 GAIN
- REV REVERSE
- X MULTIPLY
- ∫ INTEGRATE
- 1:1 BOOST
- I-O ON-OFF
- Δ DIFFERENCE
- E/P FOR INPUT/OUTPUT OF THE FOLLOWING:

INPUT/OUTPUT DESIGNATION SIGNAL

- E VOLTAGE
- I CURRENT
- H HYDRAULIC
- O ELECTROMAGNETIC SONIC SIGNAL OR LIGHT BEAM
- P PNEUMATIC
- R RESISTANCE

NOT ALL SYMBOLS SHOWN ON THIS SHEET ARE USED ON THE P&IDs

REGISTERED PROFESSIONAL ENGINEER 78496PE OREGON DECEMBER 31, 2007 BRENDAN ANDREW ROBINSON EXP. 12/31/2016

Rev.	Date	Description	By	Chk

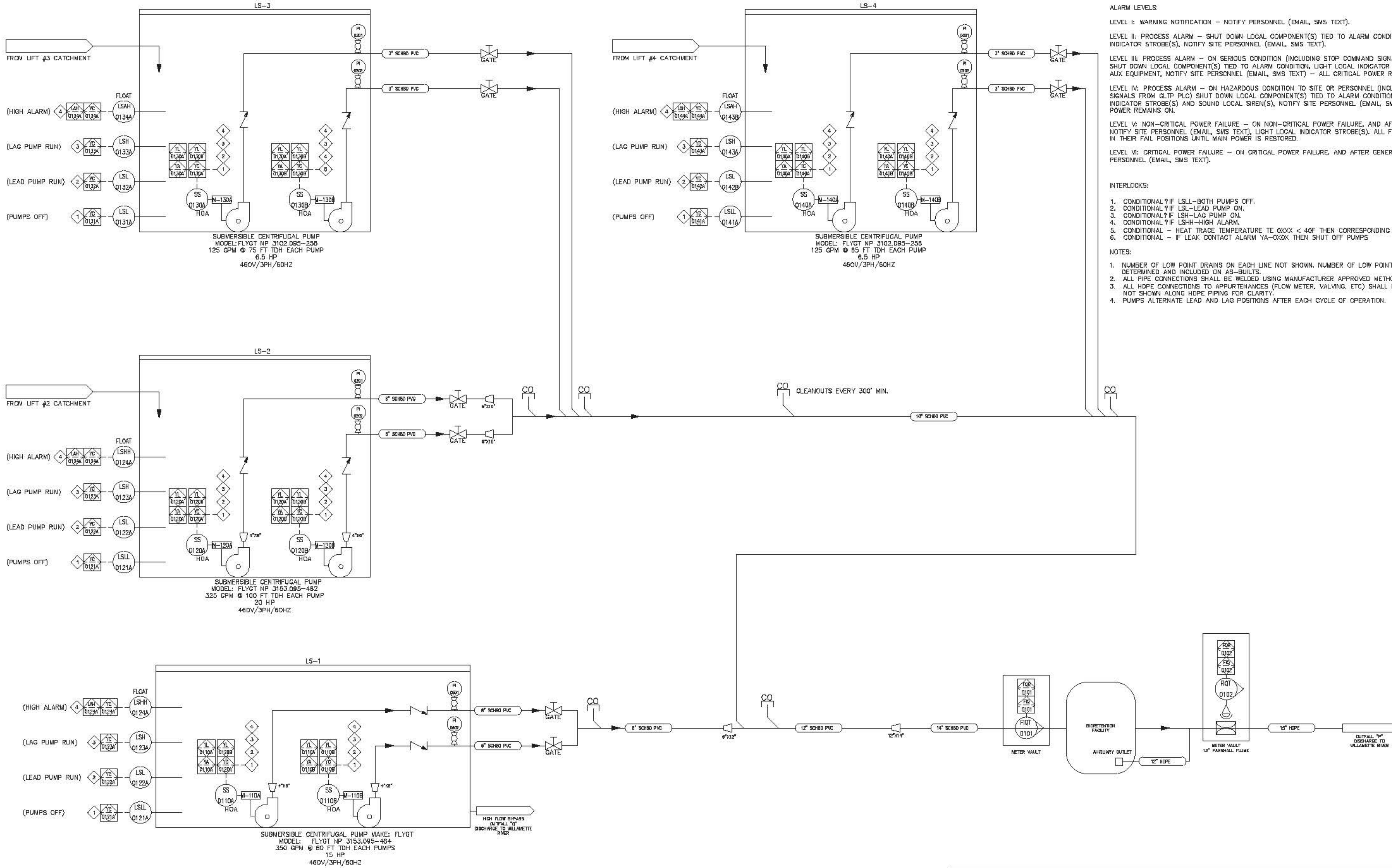
DRAWN BY PLS | DESIGNED BY AMB | CHECKED BY AMB

Environmental Resources Management
Portland, Oregon (503)-488-5282

VIGOR INDUSTRIAL LLC
PHASE 3
CONVEYANCE & BIORETENTION FACILITY
PORTLAND OREGON

PROCESS & INSTRUMENTATION DIAGRAM
STANDARD SYMBOL LEGEND

SCALE AS SHOWN | DATE JUNE 25, 2015 | ISSUE AGENCY APPROVAL | PROJECT NUMBER 0272376 | SHEET IC-01 | REV.



ALARM LEVELS:

LEVEL I: WARNING NOTIFICATION – NOTIFY PERSONNEL (EMAIL, SMS TEXT).

LEVEL II: PROCESS ALARM – SHUT DOWN LOCAL COMPONENT(S) TIED TO ALARM CONDITION, LIGHT LOCAL INDICATOR STROBE(S), NOTIFY SITE PERSONNEL (EMAIL, SMS TEXT).

LEVEL III: PROCESS ALARM – ON SERIOUS CONDITION (INCLUDING STOP COMMAND SIGNALS FROM GTLP PLC) SHUT DOWN LOCAL COMPONENT(S) TIED TO ALARM CONDITION, LIGHT LOCAL INDICATOR STROBE(S), SHUT DOWN AUX EQUIPMENT, NOTIFY SITE PERSONNEL (EMAIL, SMS TEXT) – ALL CRITICAL POWER REMAINS ON.

LEVEL IV: PROCESS ALARM – ON HAZARDOUS CONDITION TO SITE OR PERSONNEL (INCLUDING STOP COMMAND SIGNALS FROM GLTP PLC) SHUT DOWN LOCAL COMPONENT(S) TIED TO ALARM CONDITION, LIGHT LOCAL INDICATOR STROBE(S) AND SOUND LOCAL SIREN(S), NOTIFY SITE PERSONNEL (EMAIL, SMS TEXT) – ALL CRITICAL POWER REMAINS ON.

LEVEL V: NON-CRITICAL POWER FAILURE – ON NON-CRITICAL POWER FAILURE, AND AFTER GENERATOR START, NOTIFY SITE PERSONNEL (EMAIL, SMS TEXT), LIGHT LOCAL INDICATOR STROBE(S). ALL FAIL-VALVES WILL BE LEFT IN THEIR FAIL POSITIONS UNTIL MAIN POWER IS RESTORED.

LEVEL VI: CRITICAL POWER FAILURE – ON CRITICAL POWER FAILURE, AND AFTER GENERATOR START, NOTIFY SITE PERSONNEL (EMAIL, SMS TEXT).

INTERLOCKS:

1. CONDITIONAL ? IF LSLL-BOTH PUMPS OFF.
2. CONDITIONAL ? IF LSL-LEAD PUMP ON.
3. CONDITIONAL ? IF LSH-LAG PUMP ON.
4. CONDITIONAL ? IF LSHH-HIGH ALARM.
5. CONDITIONAL – HEAT TRACE TEMPERATURE TE 0XXX < 40F THEN CORRESPONDING HEAT TRACE 0XXX ON.
6. CONDITIONAL – IF LEAK CONTACT ALARM YA-0X0X THEN SHUT OFF PUMPS

NOTES:

1. NUMBER OF LOW POINT DRAINS ON EACH LINE NOT SHOWN. NUMBER OF LOW POINT DRAINS TO BE FIELD DETERMINED AND INCLUDED ON AS-BUILTS.
2. ALL PIPE CONNECTIONS SHALL BE WELDED USING MANUFACTURER APPROVED METHOD.
3. ALL HDPE CONNECTIONS TO APPURTENANCES (FLOW METER, VALVING, ETC) SHALL BE FLANGED. FLANGING NOT SHOWN ALONG HDPE PIPING FOR CLARITY.
4. PUMPS ALTERNATE LEAD AND LAG POSITIONS AFTER EACH CYCLE OF OPERATION.

REGISTERED PROFESSIONAL ENGINEER 78496PE OREGON DECEMBER 31, 2007 BRENDAN ANDREW ROBINSON

EXP. 12/31/2016

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Environmental Resources Management
Portland, Oregon (503)-488-5282

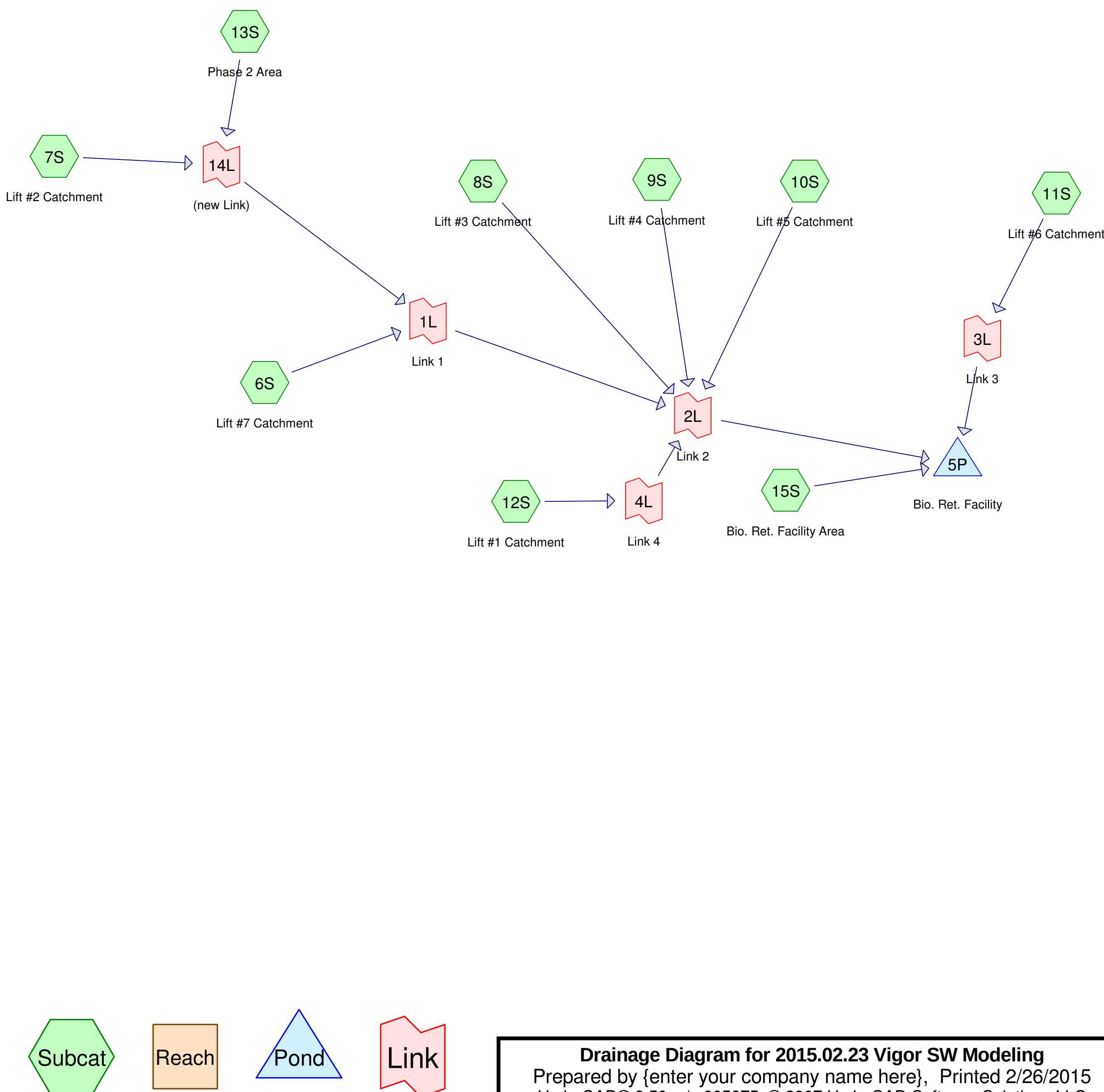
VIGOR INDUSTRIAL LLC
PHASE 3
CONVEYANCE & BIORETENTION FACILITY
PORTLAND **OREGON**

PROCESS & INSTRUMENTATION DIAGRAM
VAULTS AND LIFT STATIONS

SCALE	PROJECT NUMBER	SHEET	REV.
AS SHOWN	0272376	IC-02	

DATE JUNE 25, 2015 | ISSUE AGENCY APPROVAL

Attachment C
Phase 3 Storm Water Modeling



Drainage Diagram for 2015.02.23 Vigor SW Modeling
Prepared by {enter your company name here}, Printed 2/26/2015
HydroCAD® 8.50 s/n 005875 © 2007 HydroCAD Software Solutions LLC

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.426	80	>75% Grass cover, Good, HSG D (15S)
20.129	98	Paved parking & roofs (9S,10S,11S,12S,13S)
17.750	98	Paved roads w/curbs & sewers (6S,7S,8S)
38.305		**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Goup	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
0.000	HSG C	
0.426	HSG D	15S
37.879	Other	6S, 7S, 8S, 9S, 10S, 11S, 12S, 13S
38.305		**TOTAL AREA**

Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 6S: Lift #7 Catchment Runoff Area=7.114 ac 100.00% Impervious Runoff Depth>1.03"
Flow Length=921' Slope=0.0050 '/' Tc=6.2 min CN=98 Runoff=1.93 cfs 0.612 af

Subcatchment 7S: Lift #2 Catchment Runoff Area=7.633 ac 100.00% Impervious Runoff Depth>1.03"
Flow Length=910' Slope=0.0050 '/' Tc=6.6 min CN=98 Runoff=2.07 cfs 0.657 af

Subcatchment 8S: Lift #3 Catchment Runoff Area=3.003 ac 100.00% Impervious Runoff Depth>1.03"
Flow Length=670' Slope=0.0050 '/' Tc=5.7 min CN=98 Runoff=0.81 cfs 0.259 af

Subcatchment 9S: Lift #4 Catchment Runoff Area=2.965 ac 100.00% Impervious Runoff Depth>1.03"
Flow Length=624' Slope=0.0050 '/' Tc=4.9 min CN=98 Runoff=0.81 cfs 0.255 af

Subcatchment 10S: Lift #5 Catchment Runoff Area=1.315 ac 100.00% Impervious Runoff Depth>1.03"
Flow Length=670' Slope=0.0050 '/' Tc=5.2 min CN=98 Runoff=0.36 cfs 0.113 af

Subcatchment 11S: Lift #6 Catchment Runoff Area=5.337 ac 100.00% Impervious Runoff Depth>1.03"
Flow Length=1,103' Slope=0.0050 '/' Tc=7.4 min CN=98 Runoff=1.44 cfs 0.459 af

Subcatchment 12S: Lift #1 Catchment Runoff Area=8.222 ac 100.00% Impervious Runoff Depth>1.03"
Flow Length=966' Slope=0.0050 '/' Tc=6.1 min CN=98 Runoff=2.23 cfs 0.708 af

Subcatchment 13S: Phase 2 Area Runoff Area=2.290 ac 100.00% Impervious Runoff Depth>1.03"
Flow Length=1,370' Slope=0.0050 '/' Tc=7.9 min CN=98 Runoff=0.62 cfs 0.197 af

Subcatchment 15S: Bio. Ret. Facility Area Runoff Area=0.426 ac 0.00% Impervious Runoff Depth>0.17"
Flow Length=214' Tc=19.7 min CN=80 Runoff=0.01 cfs 0.006 af

Pond 5P: Bio. Ret. Facility Peak Elev=36.95' Storage=0.327 af Inflow=10.26 cfs 3.266 af
Outflow=3.74 cfs 3.265 af

Link 1L: Link 1 Inflow=4.62 cfs 1.466 af
Primary=4.62 cfs 1.466 af

Link 2L: Link 2 Inflow=8.82 cfs 2.801 af
Primary=8.82 cfs 2.801 af

Link 3L: Link 3 Inflow=1.44 cfs 0.459 af
Primary=1.44 cfs 0.459 af

Link 4L: Link 4 Inflow=2.23 cfs 0.708 af
Primary=2.23 cfs 0.708 af

Link 14L: (new Link) Inflow=2.69 cfs 0.854 af
Primary=2.69 cfs 0.854 af

Total Runoff Area = 38.305 ac Runoff Volume = 3.266 af Average Runoff Depth = 1.02"
1.11% Pervious = 0.426 ac 98.89% Impervious = 37.879 ac

Summary for Subcatchment 6S: Lift #7 Catchment

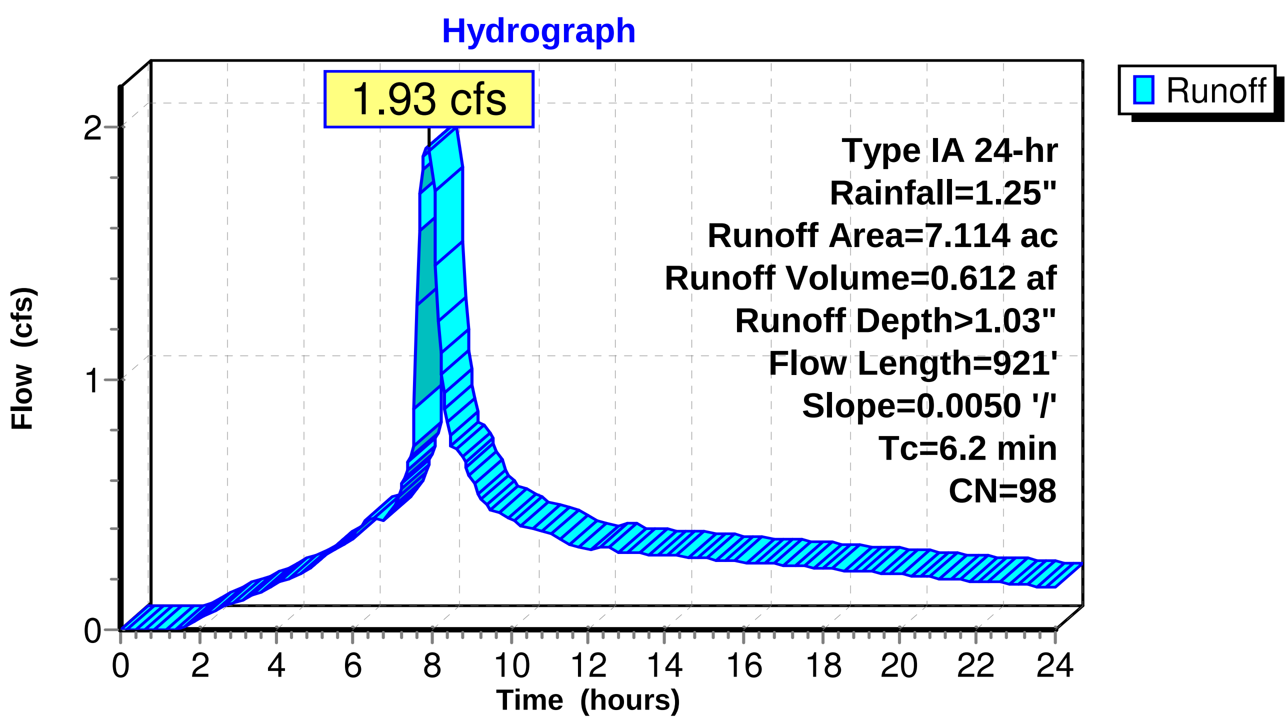
Runoff = 1.93 cfs @ 7.89 hrs, Volume= 0.612 af, Depth> 1.03"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr Rainfall=1.25"

Area (ac)	CN	Description
7.114	98	Paved roads w/curbs & sewers
7.114		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.6	50	0.0050	0.51		**Sheet Flow, sheet flow** n= 0.013 P2= 2.30"
0.7	61	0.0050	1.44		**Shallow Concentrated Flow, Shallow Concentrated Flow to Inlet** Paved Kv= 20.3 fps
3.9	810	0.0050	3.47	2.73	**Circular Channel (pipe), culvert to Lift #7** Diam= 12.0" Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012 Steel, smooth
6.2	921	Total			

Subcatchment 6S: Lift #7 Catchment



Summary for Subcatchment 7S: Lift #2 Catchment

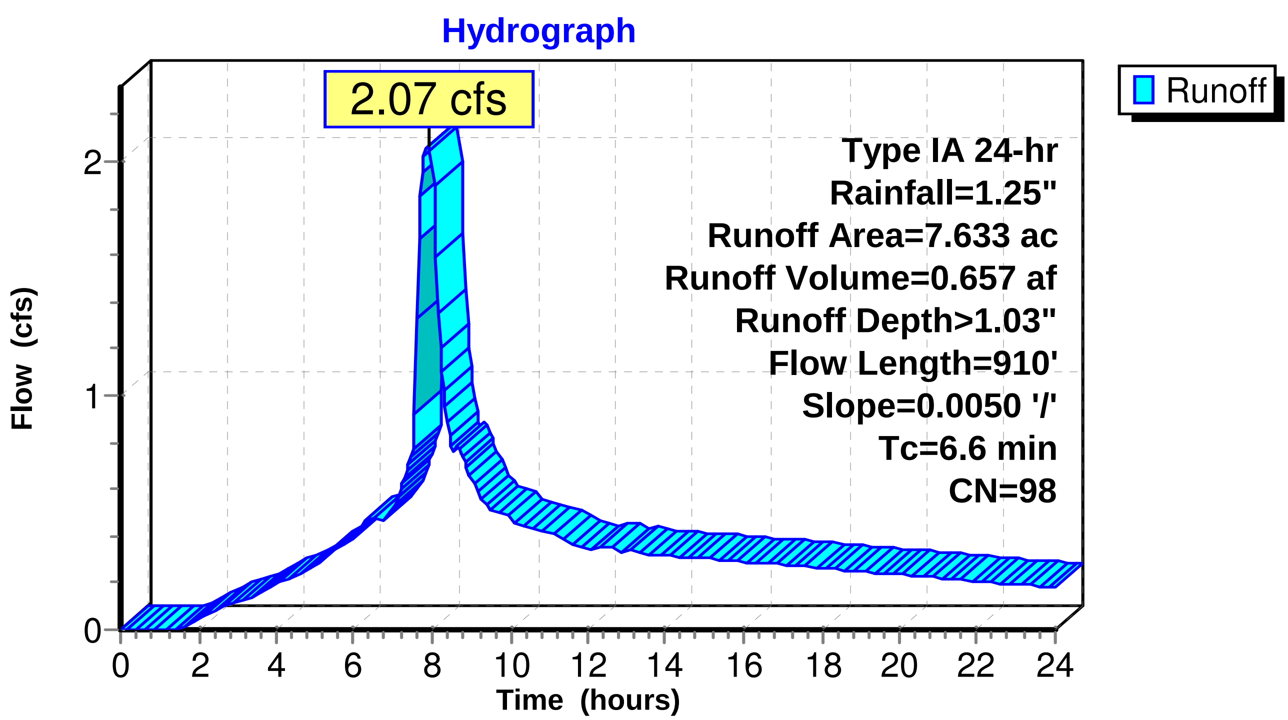
Runoff = 2.07 cfs @ 7.90 hrs, Volume= 0.657 af, Depth> 1.03"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr Rainfall=1.25"

Area (ac)	CN	Description
7.633	98	Paved roads w/curbs & sewers
7.633		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.6	50	0.0050	0.51		**Sheet Flow, sheet flow** n= 0.013 P2= 2.30"
1.5	129	0.0050	1.44		**Shallow Concentrated Flow, Shallow Concentrated Flow to Inlet** Paved Kv= 20.3 fps
3.5	731	0.0050	3.47	2.73	**Circular Channel (pipe), culvert flow to Lift #2** Diam= 12.0" Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012 Steel, smooth
6.6	910	Total			

Subcatchment 7S: Lift #2 Catchment



Summary for Subcatchment 8S: Lift #3 Catchment

[49] Hint: Tc<2dt may require smaller dt

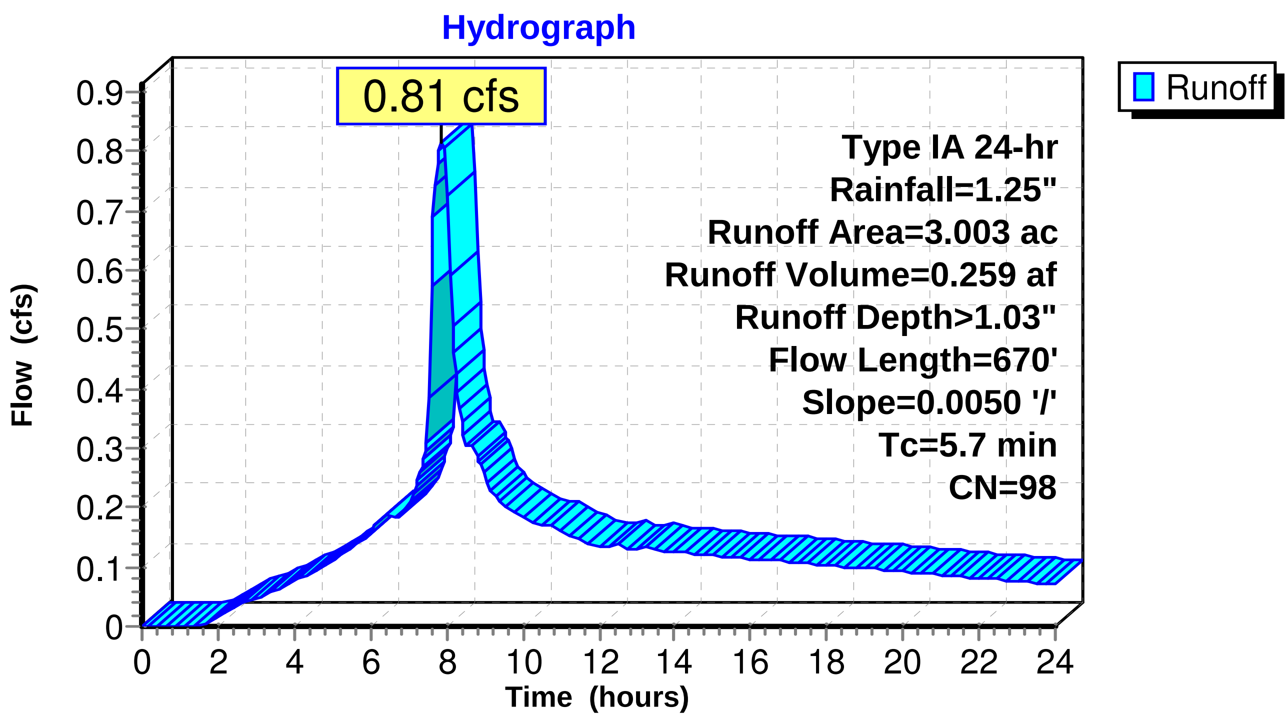
Runoff = 0.81 cfs @ 7.89 hrs, Volume= 0.259 af, Depth> 1.03"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr Rainfall=1.25"

Area (ac)	CN	Description
3.003	98	Paved roads w/curbs & sewers
3.003		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.6	50	0.0050	0.51		**Sheet Flow, sheet flow** n= 0.013 P2= 2.30"
1.9	160	0.0050	1.44		**Shallow Concentrated Flow, Shallow Concentrated Flow to Inlet** Paved Kv= 20.3 fps
2.2	460	0.0050	3.47	2.73	**Circular Channel (pipe), culvert flow to Lift #3** Diam= 12.0" Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012 Steel, smooth
5.7	670	Total			

Subcatchment 8S: Lift #3 Catchment



Summary for Subcatchment 9S: Lift #4 Catchment

[49] Hint: Tc<2dt may require smaller dt

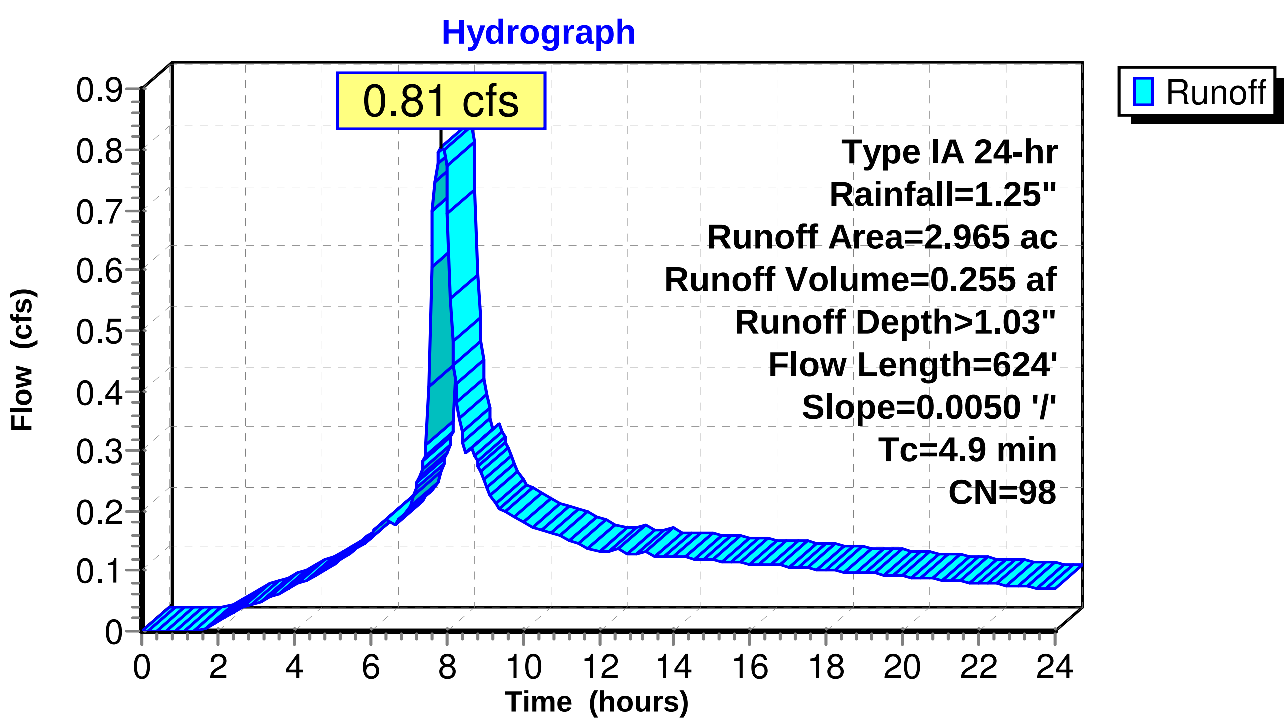
Runoff = 0.81 cfs @ 7.87 hrs, Volume= 0.255 af, Depth> 1.03"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr Rainfall=1.25"

Area (ac)	CN	Description
2.965	98	Paved parking & roofs
2.965		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.6	50	0.0050	0.51		**Sheet Flow, sheet flow** n= 0.013 P2= 2.30"
1.0	87	0.0050	1.44		**Shallow Concentrated Flow, Shallow Concentrated Flow to Inlet** Paved Kv= 20.3 fps
2.3	487	0.0050	3.47	2.73	**Circular Channel (pipe), Culvert to Lift #4** Diam= 12.0" Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012 Steel, smooth
4.9	624	Total			

Subcatchment 9S: Lift #4 Catchment



Summary for Subcatchment 10S: Lift #5 Catchment

[49] Hint: Tc<2dt may require smaller dt

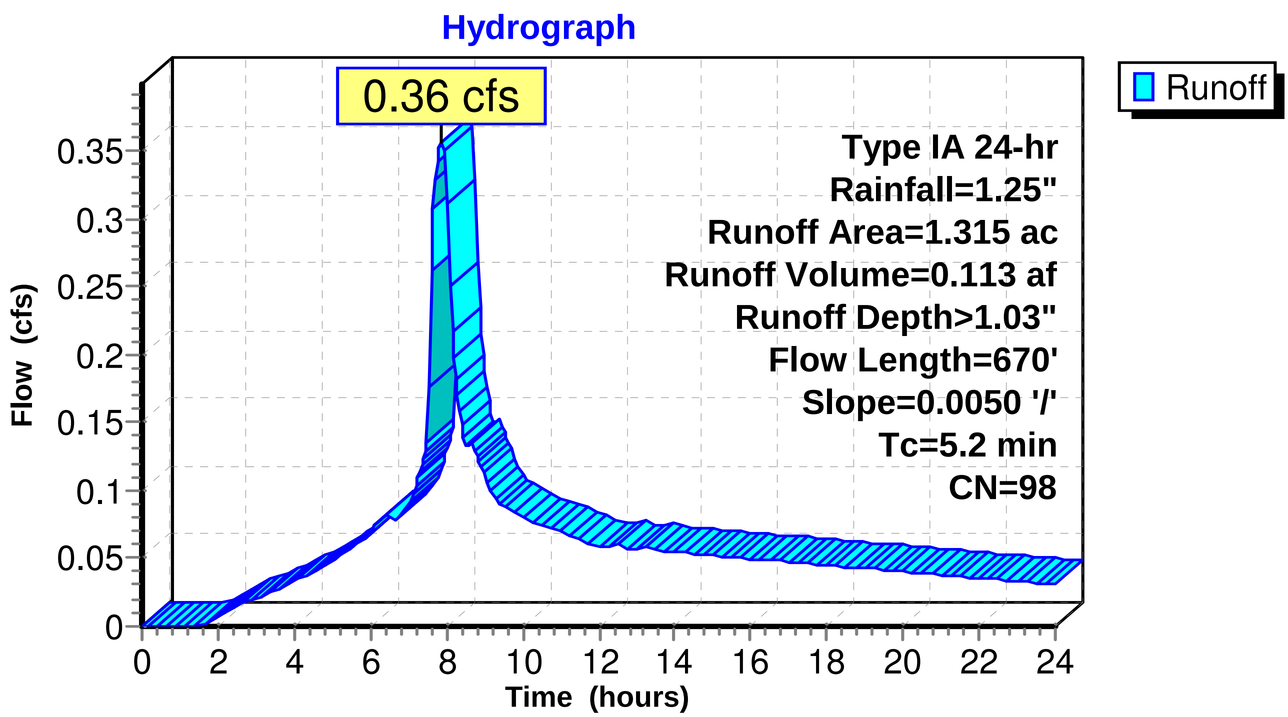
Runoff = 0.36 cfs @ 7.88 hrs, Volume= 0.113 af, Depth> 1.03"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr Rainfall=1.25"

Area (ac)	CN	Description
1.315	98	Paved parking & roofs
1.315		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.6	50	0.0050	0.51		**Sheet Flow, sheet flow** n= 0.013 P2= 2.30"
1.0	84	0.0050	1.44		**Shallow Concentrated Flow, Shallow Concentrated Flow to Inlet** Paved Kv= 20.3 fps
2.6	536	0.0050	3.47	2.73	**Circular Channel (pipe), culvert flow to Lift #5** Diam= 12.0" Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012 Steel, smooth
5.2	670	Total			

Subcatchment 10S: Lift #5 Catchment



Summary for Subcatchment 11S: Lift #6 Catchment

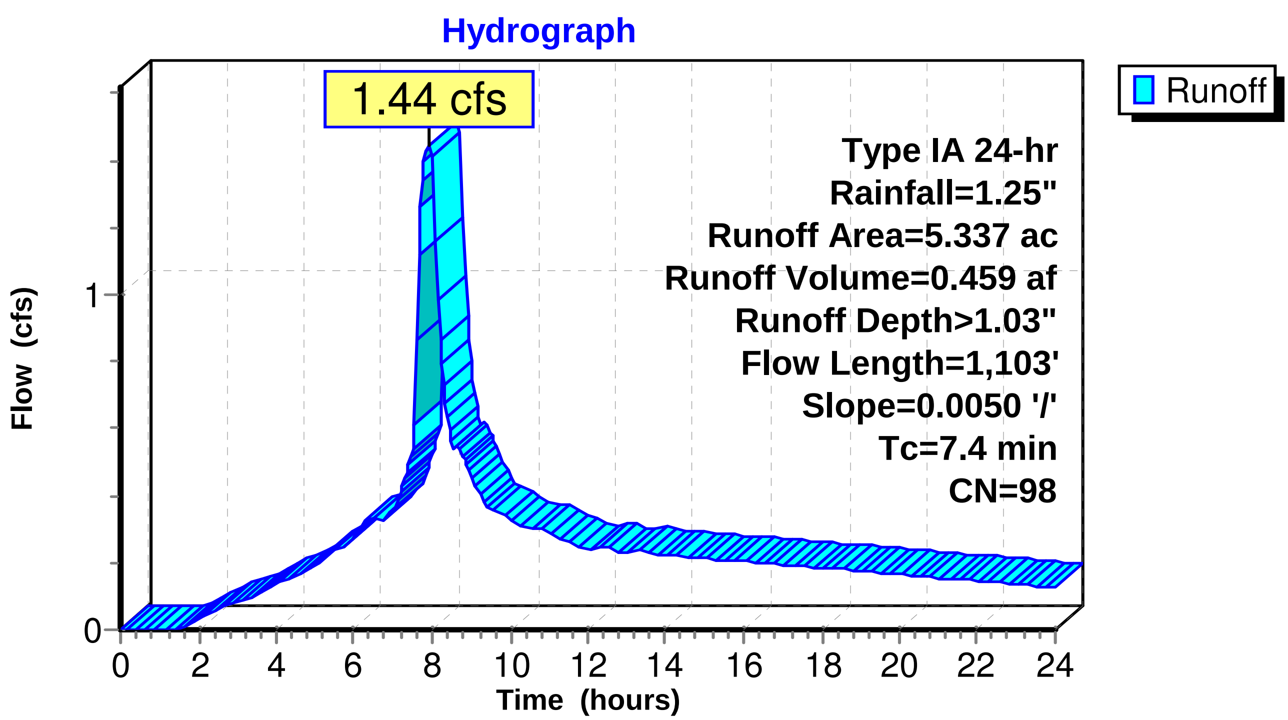
Runoff = 1.44 cfs @ 7.91 hrs, Volume= 0.459 af, Depth> 1.03"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr Rainfall=1.25"

Area (ac)	CN	Description
5.337	98	Paved parking & roofs
5.337		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.6	50	0.0050	0.51		**Sheet Flow, sheet flow** n= 0.013 P2= 2.30"
1.3	109	0.0050	1.44		**Shallow Concentrated Flow, Shallow Concentrated Flow to Inlet** Paved Kv= 20.3 fps
4.5	944	0.0050	3.47	2.73	**Circular Channel (pipe), Culvert to Lift #6** Diam= 12.0" Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012 Steel, smooth
7.4	1,103	Total			

Subcatchment 11S: Lift #6 Catchment



Summary for Subcatchment 12S: Lift #1 Catchment

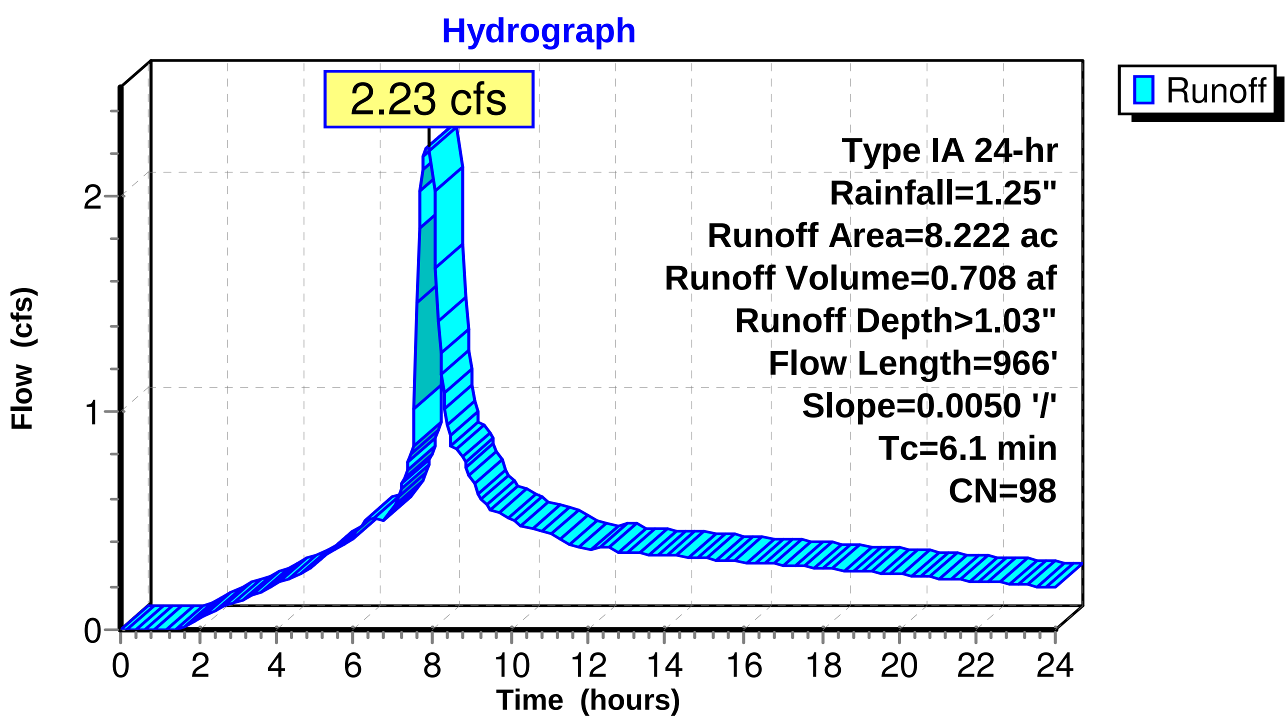
Runoff = 2.23 cfs @ 7.89 hrs, Volume= 0.708 af, Depth> 1.03"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr Rainfall=1.25"

Area (ac)	CN	Description
8.222	98	Paved parking & roofs
8.222		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.6	50	0.0050	0.51		**Sheet Flow, sheet flow** n= 0.013 P2= 2.30"
0.2	16	0.0050	1.44		**Shallow Concentrated Flow, Shallow Concentrated Flow to Inlet** Paved Kv= 20.3 fps
4.3	900	0.0050	3.47	2.73	**Circular Channel (pipe), culvert to Lift #1** Diam= 12.0" Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012 Steel, smooth
6.1	966	Total			

Subcatchment 12S: Lift #1 Catchment



Summary for Subcatchment 13S: Phase 2 Area

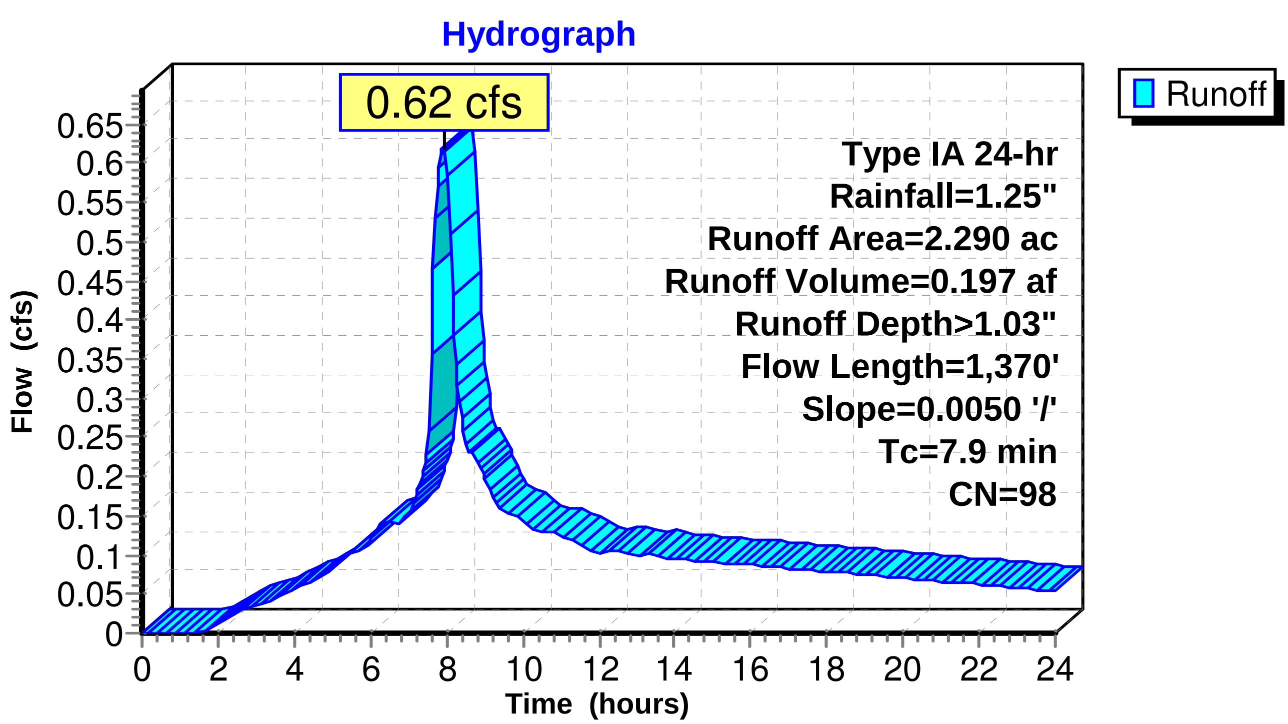
Runoff = 0.62 cfs @ 7.92 hrs, Volume= 0.197 af, Depth> 1.03"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr Rainfall=1.25"

Area (ac)	CN	Description
2.290	98	Paved parking & roofs
2.290		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.6	50	0.0050	0.51		**Sheet Flow, sheet flow** n= 0.013 P2= 2.30"
6.3	1,320	0.0050	3.47	2.73	**Circular Channel (pipe), culvert flow to Lift #2** Diam= 12.0" Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012 Concrete pipe, finished
7.9	1,370	Total			

Subcatchment 13S: Phase 2 Area



Summary for Subcatchment 15S: Bio. Ret. Facility Area

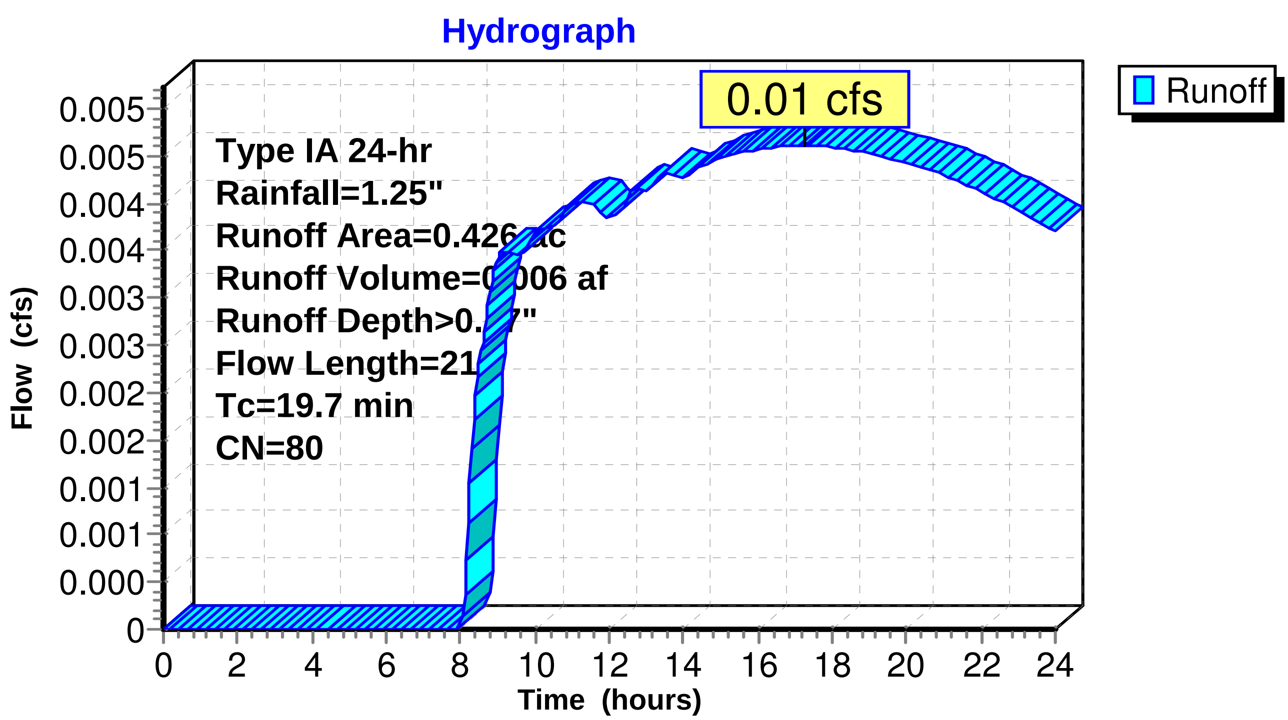
Runoff = 0.01 cfs @ 17.23 hrs, Volume= 0.006 af, Depth> 0.17"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr Rainfall=1.25"

Area (ac)	CN	Description
0.426	80	>75% Grass cover, Good, HSG D
0.426		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.6	50	0.0050	0.07		**Sheet Flow, sheet flow** Grass: Short n= 0.150 P2= 2.30"
8.1	164	0.0005	0.34		**Shallow Concentrated Flow, Shallow Concentrated Flow to Outfall** Grassed Waterway Kv= 15.0 fps
19.7	214	Total			

Subcatchment 15S: Bio. Ret. Facility Area



Summary for Pond 5P: Bio. Ret. Facility

Inflow Area = 38.305 ac, 98.89% Impervious, Inflow Depth > 1.02"
Inflow = 10.26 cfs @ 7.90 hrs, Volume= 3.266 af
Outflow = 3.74 cfs @ 8.76 hrs, Volume= 3.265 af, Atten= 64%, Lag= 51.9 min
Primary = 3.74 cfs @ 8.76 hrs, Volume= 3.265 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 36.95' @ 8.76 hrs Surf.Area= 0.369 ac Storage= 0.327 af

Plug-Flow detention time= 17.3 min calculated for 3.258 af (100% of inflow)
Center-of-Mass det. time= 16.9 min (717.6 - 700.7)

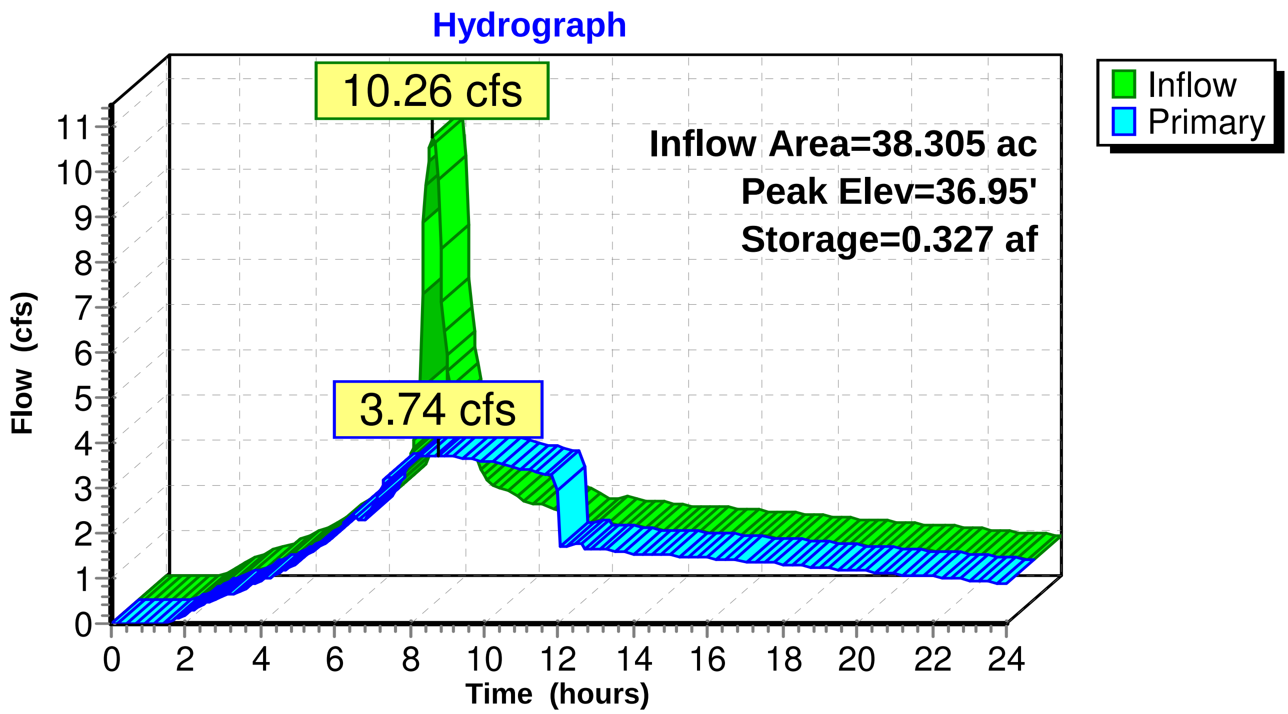
Volume	Invert	Avail.Storage	Storage Description
#1	36.00'	0.745 af	**Custom Stage Data (Pyramidal)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)	Wet.Area (acres)
36.00	0.321	0.000	0.000	0.321
37.00	0.372	0.346	0.346	0.373
38.00	0.426	0.399	0.745	0.429

Device	Routing	Invert	Outlet Devices
#1	Primary	36.00'	**10.000 in/hr Exfiltration over Wetted area**

Primary OutFlow Max=3.74 cfs @ 8.76 hrs HW=36.95' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 3.74 cfs)

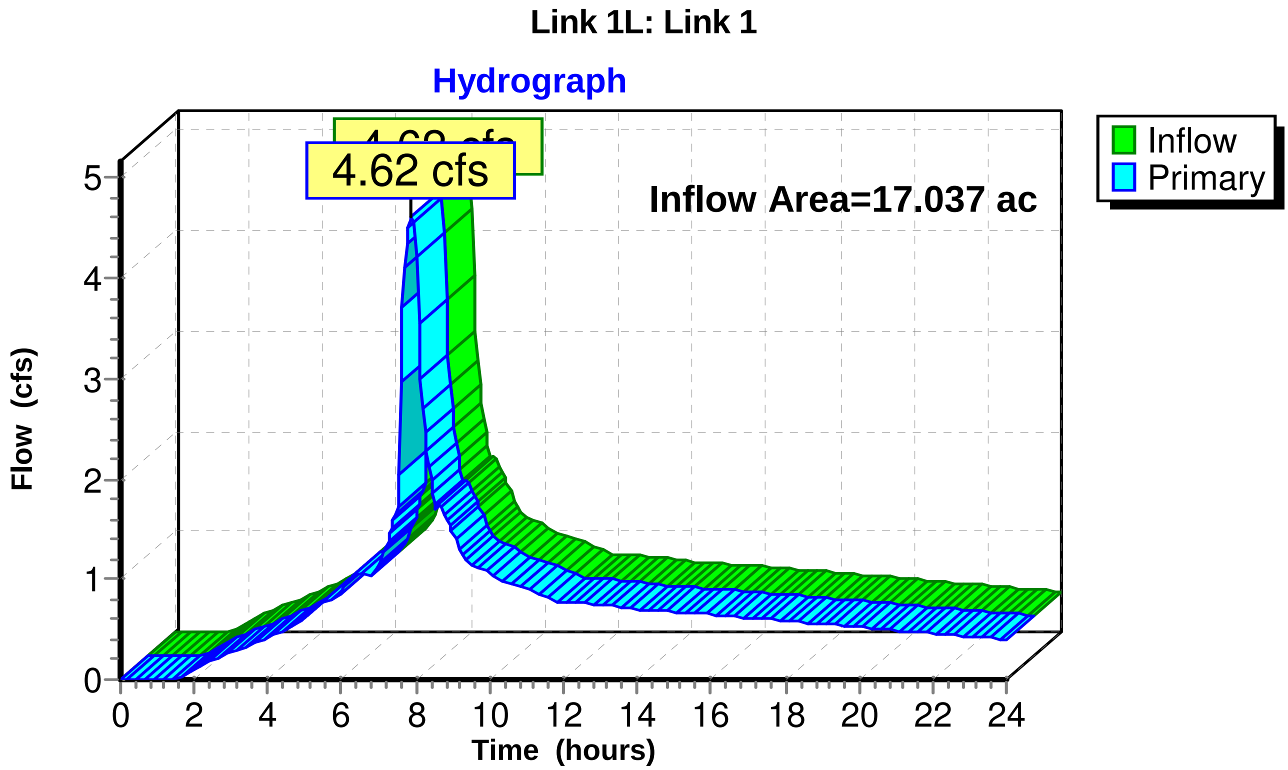
Pond 5P: Bio. Ret. Facility



Summary for Link 1L: Link 1

Inflow Area = 17.037 ac,100.00% Impervious, Inflow Depth > 1.03"
Inflow = 4.62 cfs @ 7.90 hrs, Volume= 1.466 af
Primary = 4.62 cfs @ 7.90 hrs, Volume= 1.466 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

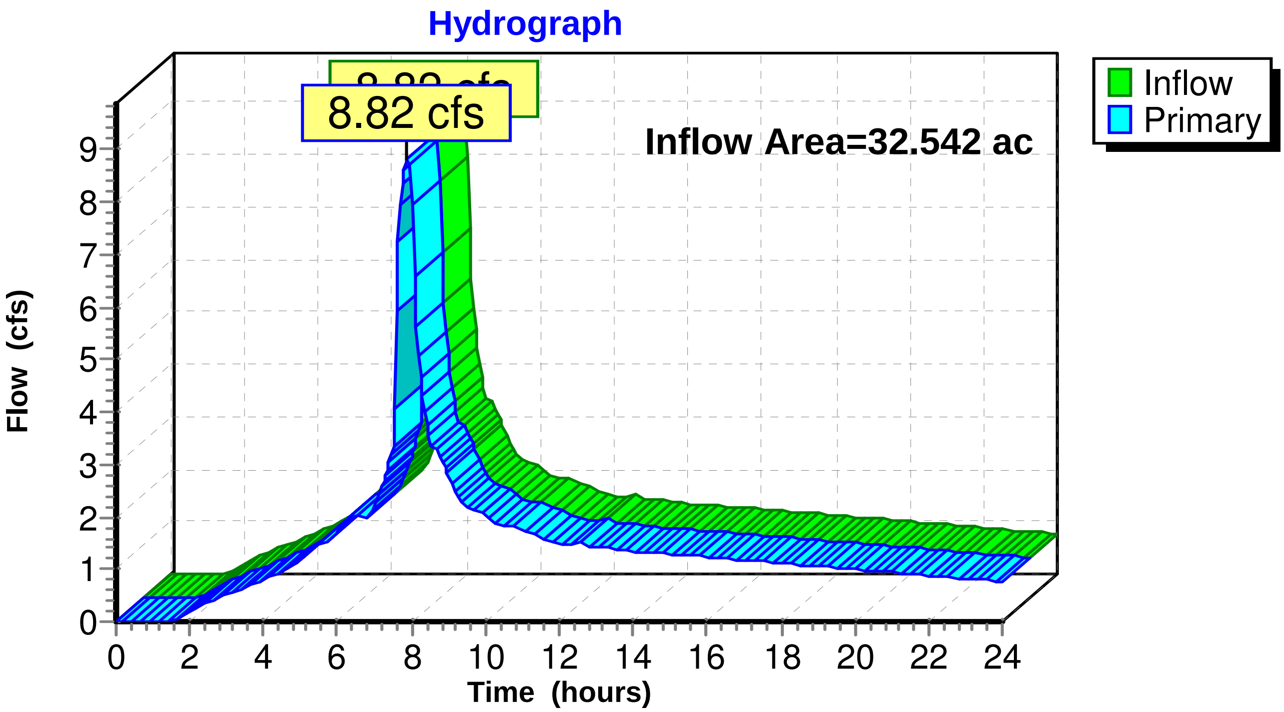


Summary for Link 2L: Link 2

Inflow Area = 32.542 ac,100.00% Impervious, Inflow Depth > 1.03"
Inflow = 8.82 cfs @ 7.89 hrs, Volume= 2.801 af
Primary = 8.82 cfs @ 7.89 hrs, Volume= 2.801 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

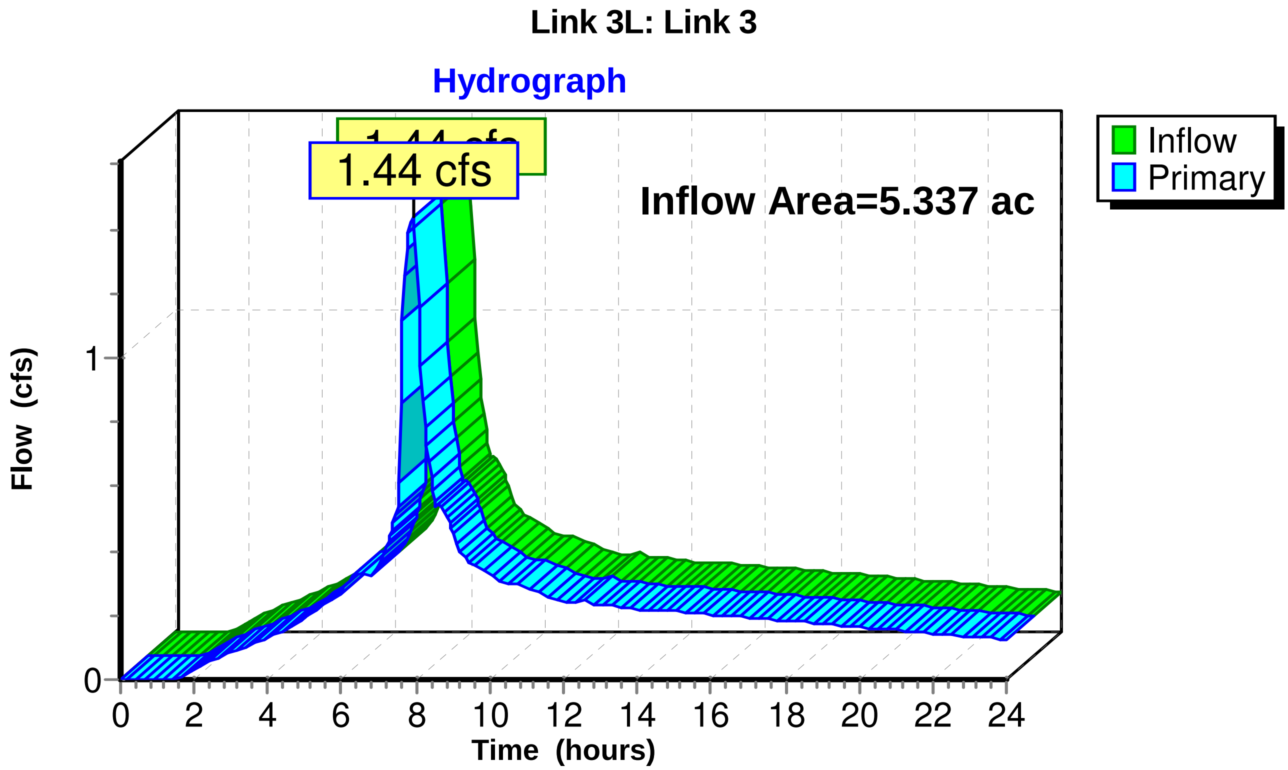
Link 2L: Link 2



Summary for Link 3L: Link 3

Inflow Area =	5.337 ac,100.00% Impervious,	Inflow Depth > 1.03"		
Inflow =	1.44 cfs @	7.91 hrs, Volume=	0.459 af	
Primary =	1.44 cfs @	7.91 hrs, Volume=	0.459 af,	Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

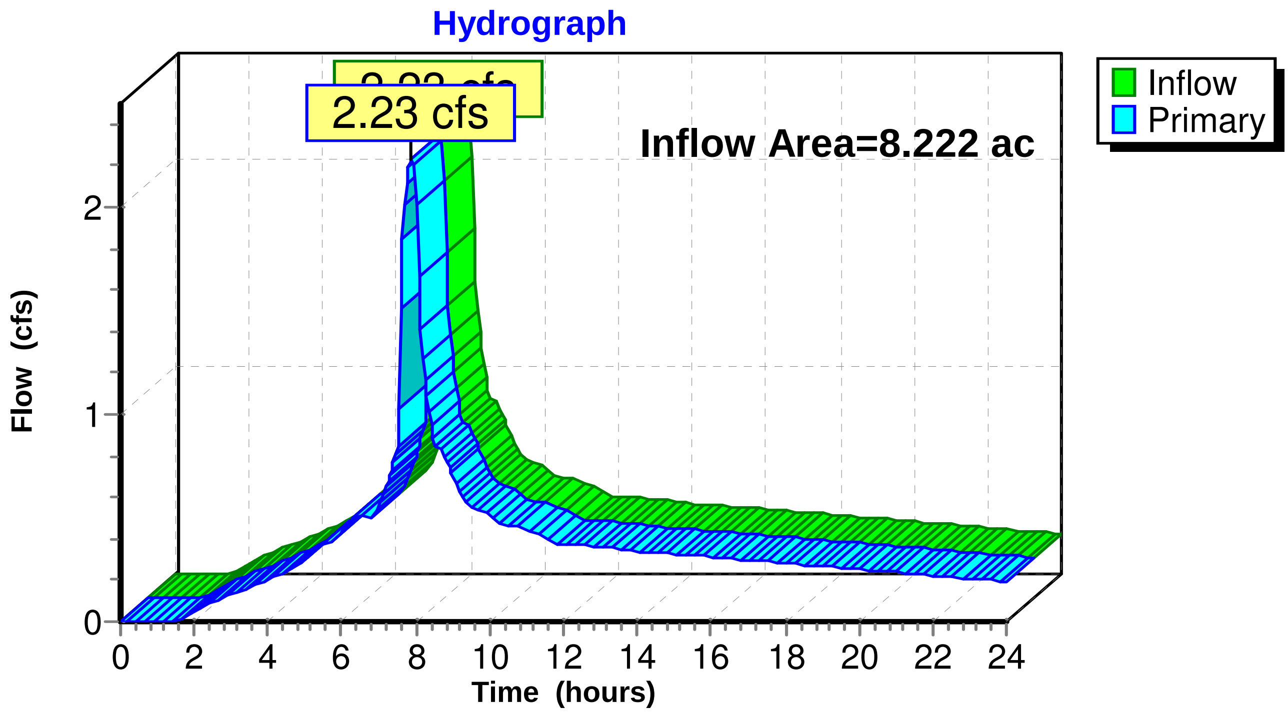


Summary for Link 4L: Link 4

Inflow Area =	8.222 ac,100.00% Impervious,	Inflow Depth > 1.03"			
Inflow =	2.23 cfs @	7.89 hrs,	Volume=	0.708 af	
Primary =	2.23 cfs @	7.89 hrs,	Volume=	0.708 af,	Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Link 4L: Link 4

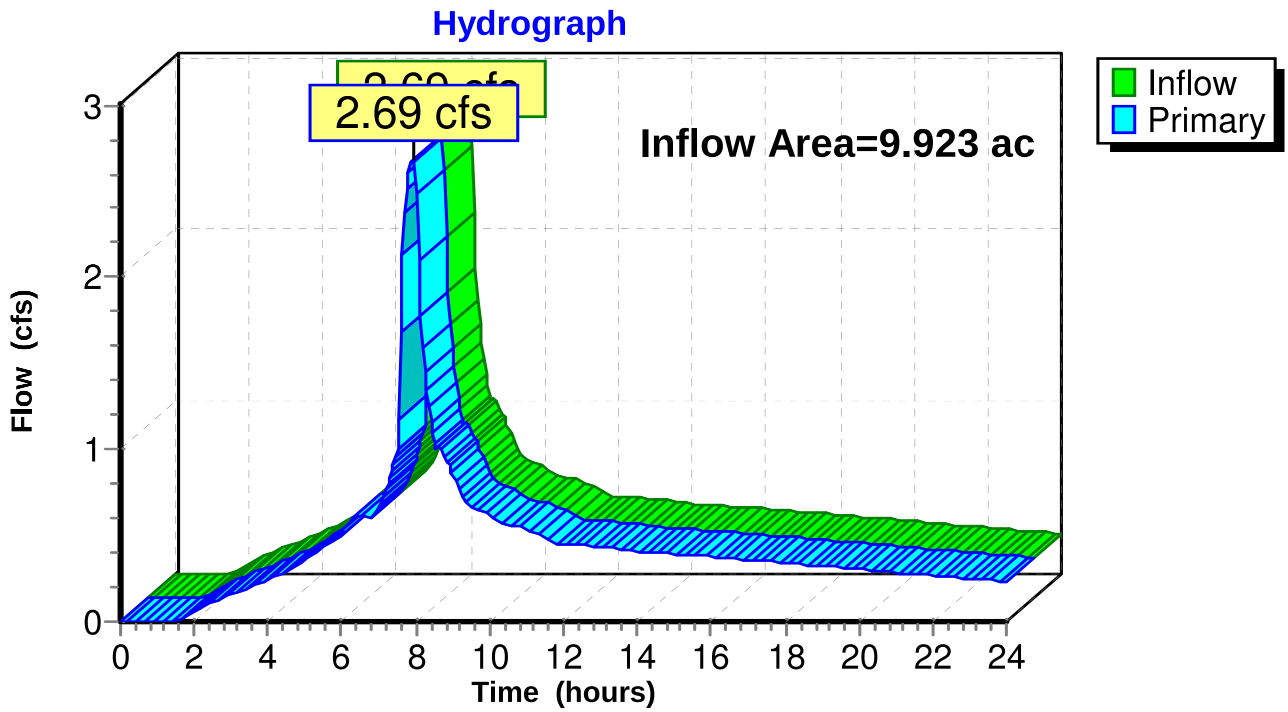


Summary for Link 14L: (new Link)

Inflow Area = 9.923 ac,100.00% Impervious, Inflow Depth > 1.03"
Inflow = 2.69 cfs @ 7.91 hrs, Volume= 0.854 af
Primary = 2.69 cfs @ 7.91 hrs, Volume= 0.854 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Link 14L: (new Link)



Attachment D
Phase 3 Hydraulic Design Modeling

ATTACHMENT D - Vigor Industrial Stormwater Lift Station Pump Design Calculations - REV 06/09/15

Lift Station / Pipe run	#2	#7	#2/#7 to #3	#3	#2/#3 to #4	#4	#2/3/4 to #1/6	#1	#1/2/3/4 to #6	#6	Combined Flow to Bioretention Pond
Drain Area											
Peak runoff, GPM	692	688		274		270		746		516	
Dual Pump Design, GPM (7)	650	650	1300	250	1550	250	1800	700	2500	500	3000
Single Pump rate, GPM (1)	325	325		125		125		350		250	
Rim El, ft	37	31.91		37		37		35.5		37	40
Pump intake El, ft	23	18.5	30	23	31.5	23	31.5	21.5	31.5	23	31.5
Design Water Level, ft (4)	25	20.5		25		25		23.5		25	
Run length, ft (6)			1069	30	366	30	200	283	563	210	1130
Nom Diameter (SCH80 PVC)	6	6	10	3	10	3	10	6	12	4	14
Actual Diameter, in. (3)	5.761	5.761	9.564	2.9	9.564	2.9	9.564	5.761	11.376	3.826	12.5
Velocity, dual pump, ft/s	8.00	8.00	5.81	n/a	6.92	n/a	8.04	8.62	7.89	n/a	7.84
Velocity, single pump, ft/s	4.00	4.00	n/a	6.07	n/a	6.07		4.31		6.98	
Dual Pump Hydraulics (2)(5)											
Static loss	89.12	93.62	66.74	71.74	55.8	62.3	47.38	55.38	32.92	39.42	8.5
Piping loss	4.75	4.75	15.55	2.54	7.37	2.54	5.3	15.41	11.76	6.14	20.95
fitting loss	5.17	5.17	1.83	1.69	2.07	1.68	3.12	5.72	2.7	2.51	3.47
Total loss	99.04	103.54	84.12	75.97	65.24	66.52	55.8	76.51	47.38	48.07	32.92
Pump design - all pumps											
FLOW RATE, GPM	**325**	**325**		**125**		**125**		**350**		**250**	
NUMBER OF PUMPS	**2**	**2**		**2**		**2**		**2**		**2**	
TOTAL FLOW RATE, GPM	**650**	**650**		**250**		**250**		**700**		**500**	**3000**
HEAD (TDH), Ft	**99.04**	**103.54**		**75.97**		**66.52**		**76.51**		**48.07**	

Calculation Notes / Assumptions

1. "Single" pump flow is the contribution of one pump when both are operating. If only one pump is operating (lead pump) then the rate of that pump will be higher.
2. Pipe roughness is set at 120 (steel pipe) which is more conservative than for PVC.
3. Pipe diameters based on SCH80 wall thickness -- if a thinner wall pipe is used the then dynamic losses will be lower.
4. Pump inlet water elevation assumed to be 2' above the pump intake, or 3' above the bottom of the manhole.
5. HYDROFLO pump hydraulics program; based on Hazen-Williams equation; water at ambient temperature.
6. Pipe lengths taken from "MLB_working site Plan-Model-Pipe Lengths.pdf"
7. Pump out rate allows for no more than ~ 500 gallons accumulation at peak of storm event